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Vol. XII.

PART I.

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PART I.

ASIATIC PALMS–LEPIDOCARYEAE

By

DR. ODOARDO BECCARI.

PART II.

THE SPECIES OF DAEMONOROPS

WITH 109 PLATES AND 2 PLATES OF ANALYTICAL FIGURES.

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CONTENTS.

Page.

I Introductory Essay

- i The Stem 1
- ii The Leaves 1
- iii The Leaf-Sheaths 1
- iv The Ocrea 2
- v The Spadices and Spathes 2
- vi The Spikelets 4
- vii The Flower 6
- viii The Fruit 7
- ix The Seed 8
- x Floral and Extra-floral Nectaries 9
- xi Myrmecophilism 10
- xii Uses of the Daemonorops 11
- xiii Geographical Distribution . . . . 12—16
- xiv Generic differences between Daemonorops and Calamus . . . 16
- xv Tables of Geographical Distribution . . . . 17—23

II Definition of the genus Daemonorops 25

III Conspectus of the Species 26

IV Key to the section Cymbospatha . . . . 28—32

V Key to the section Piptospatha . . . . 33—40

VI Detailed Descriptions of Species . . . . 41—213

VII Addenda . . . . 217—231

VIII Imperfectly known, doubtful or excluded species . . . 231

IX Description of analytical plates 233, 234

X Index to Species 235

XI Index to Plates 237

DAEMONOROPS.

INTRODUCTION.

I.—The Stem.

In respect of the conditions of existence in general, of the nature of the vegetative organs, and in especial of the stem, all that has been already said regarding the *Calami* may equally be said of the *Daemonorops*, which, for the most part, are typical climbing palms: nevertheless certain mountain species, such as *D. petiolaris, D. microthamnus, D. monticolus, D. tabacinus, D. calicarpus, D. Kunstlerii,* form exceptions, as also *D. brevipes* (a species inhabiting lower regions), in all of which the scandent nature is more or less masked.

Also *D. microstachys*, *D. scapigerus*, and *D. acanthobolus*, possess a very short and erect stem. Some species, moreover, which begin to flower while still very young, may at first be erect, and become scandent only with age.

II.—The Leaves.

All the *Daemonorops* (comprising also those which are only very slightly or not at all scandent) have the leaves of the upper portion of their stems more or less cirriferous. Contrary, therefore, to what occurs in the *Calami*, no *Daemonorops* is known of which every leaf is unfurnished with cirri, although in all the representatives of this genus the radical leaves and those of the lowest portion of the stem are always wanting in this appendix, and terminate in two small leaflets. In *D. ursinus* only have I found the terminal cirrus almost rudimentary. The leaflets of the leaves in *Daemonorops* are always more or less linear in shape; only in a very few species do they assume an oblong form (*D. didymophyllus*), but never an oval or a rhomboidal; their extremities are always acuminate, never truncate or premorse; they are always straight and symmetrical, never sigmoid, or with evanescent nerves along their margins; usually they are uni-costate, or at most sub-tri-costulate, and, with the exception of *D. macrophyllus*, never truly 5-costulate.

III.—The Leaf-sheaths.

The leaf-sheaths never bear *flagella;* in the high scandent species, the leaf-sheaths at the summit are gibbous in form, and, as in the *Calami*, are armed with spines. There is, however, a kind of spinescence which appears to be peculiar to a special group of *Daemonorops*, namely, that group in which the spines, united at their bases, form a membranous circle or collar around the leaf-sheaths.

These circles or collars again are sometimes disposed in pairs, so as to form, between each pair, a kind of circular gallery, in which ants take up their abode, as will be more fully explained later.

The spines of *D. oxycarpus* are also very singular, being quasi-membranous, and at the same time apparently formed by the coalescence of several slender spines; such spines would appear less intended to protect the plant, than (like the membranous circles already mentioned) to furnish a point of support for ants which construct amongst them their habitations of the most heterogeneous materials.

In the species belonging to the groups of *D. Hystrix* and *D. Draco* and in *D. ruptilis*, the leaf-sheaths are armed at their mouths with large, erect, and laminar spines: these in *D. Hystrix* at times attain the extraordinary length of 30 cm., and are 7—8 mm. wide at their base.

IV.—The Ocrea.

This is almost always very short, and generally reduced to a small ring, or ligula, at the junction of the leaf-stalk with the leaf-sheath.

Usually the ocrea is glabrous, but in *D. ochrolepis*, in *D. longipes* and in a few others it is densely hispid. In one (and only one) species, *D. ursinus*, I have found two filiform appendages at the side of the base of the leaf-stalk, densely hispid and 20—25 cm. long, which would appear to be morphologically derived from the ocrea, and to be therefore analogous to the large stipuliform auricles which are found at the base of the leaf-stalk in *Calamus erectus*.

V.—Spadices and Spathes.

The spadices of the *Daemonorops* differ notably from those of the *Calami* as much in the spathes as in the axial parts. As in the *Calami*, they nearly always spring laterally from a leaf-sheath, but sometimes in certain small non-scandent species they approach by degrees to the apex of the stem, and are mixed with leaves, greatly reduced in size, in such a manner as almost to form a compound terminal inflorescence (*D. petiolaris*, *D. microthamnus*, *D. calicarpus*). The spadices of *Daemonorops* are never unusually elongated, nor are they ever cirriferous at their extremity, even in a rudimentary manner; also every kind of spine is wanting in the axial parts above the base of the peduncular part, that is, from the insertion of the outermost spathe upwards. *D. longispathus* alone—the male spadix of which sometimes attains a length of over two metres—possesses an extremely slender axial portion, which however is quite free from spines. As in the *Calami*, the spadices of *Daemonorops* are always dioecious, though one may sometimes happen to meet with a male spadix with a hermaphrodite flower here and there.* It is possible that the female spadices of some *Cymbospathae* are sometimes cleistogamous—at least, I suppose they may be, having observed that certain still closed spadices

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*Mr. H. N. Ridley (*Mat. Fl. Malay. Pen.* ii, 171) says that the spadices of the *Daemonorops* are usually unisexual, and that male and female inflorescences are on the same stem—a fact which I have never observed. The same author (l. c. p. 172) adds that "both sexes occur on the same plant": furthermore, he describes the spadix of *D. angustifolius* as having a "bisexual spadix, male and female flowers on the same spadix in pairs." Apparently Mr. Ridley has considered as a fertile male flower the neutral or sterile flower which accompanies every female flower on the female spadix in all the species of *Daemonorops* I have examined.

of *D. fissus* contained ovaries in process of development, which had every appearance of having been already fecundated. The closure may however have been more apparent than real, and thus an insect may have been able to penetrate into the interior through the half-closed spathes. In the *Daemonorops* two very distinct forms of spadices may be distinguished, namely, that proper to the species belonging to the section *Cymbospatha* and that belonging to the section *Piptospatha.*

In *Cymbospatha* the spadices, unopened or still completely enveloped by the spathes (♂ and ♀), are at the moment preceding anthesis fusiform, more or less thick in the centre and prolonged into a kind of elongated beak, which at times exceeds the body of the spadix itself in length. Nevertheless this beak is part of the spathe, which in this group is highly specialized, and very different from that of the *Calami*, although, as in the latter, all principal ramifications of the spadix, or partial inflorescences, have their own proper spathe.

Such spathes are not in the least tubular, but are concave and of the shape of an elongated fusiform boat. Of these primary spathes, the outermost is the largest, and includes within it all the others, inclusive of the beaks belonging to each. The greater number are double-keeled at the back.

When the panicle within the spathes is ready to expand into flower, the outermost spathe splits open all down one side, and each of the inner spathes follows the example in turn. The outermost spathe of the *Cymbospathae* is invariably, though to a greater or lesser degree, furnished with spines more or less laminar, often subulate or aculeate or again even like bristles, but always straight, never uncinate or clawed. Of the inner spathes, the second and third usually bear a few dorsal spines, or they may be quite bare.

The unopened spathes of the species belonging to *Piptospatha* are always of a more or less elongated and cylindrical form, and in that state are rarely thicker than a finger; from the first their spathes are all tubular, inclusive of the outermost, which, in these species, does not completely enclose the internal spathes: the latter issue from its open apex in gradation like the tubes of a telescope, hence each internal spathe rises more or less, according to its species, above the one below.

The primary spathe of *D. macropterus* and of *D. lamprolepis* and also that of *D. Motleyi* form almost a connecting link with those of *Cymbospatha*, in so far as before the anthesis their external spathe does, except at the extreme apex, enclose the internal spathes completely, and only fails to entirely envelope them because it does not possess a beak capable of covering the tips of all the others.

In the species belonging to the group of *D. Draco*, the spathes are thick and coriaceous, the external spathe frequently persists longer than the others, and is armed with short stout thorns, which are however never clawed.

In other species of the group of the *Piptospathae* (*D. cristatus*, *D. geniculatus*, *D. longipes*, *D. longispathus*) the spathes are thin, paper-like, and either bare or variously setulose.

In no case do the spathes of *Daemonorops* after the anthesis appear long and tubular, nor do they closely sheathe the axial portion of the spadix. In *Daemonorops* the axial portion of the spadix is often very short, much more in *Cymbospatha* than in *Piptospatha.*

In all the species of the group *Piptospatha* the male panicle is usually more elongated than the female; thus the male panicle of the species belonging to the group of *D. Draco* is almost always very strictly cupressiform, while the female is loosely and diffusely paniculate at least during the period of fructification. Only in a few species (*D. geniculatus*, *D. longipes* and *D. longispathus*) is the male panicle comparatively large and spreading. In *D. scapigerus* the panicle is very short, and borne on a long and slender peduncular portion. In the species of group *Cymbospatha*, the internodes of the female spadices are very short, and often swollen in their basal part.

Very frequently the various organs of *Daemonorops*, and specially those of the species belonging to the section *Cymbospatha*, are covered with a rusty or tobacco-coloured indumentum, which is extremely characteristic and is exceedingly noticeable in *D. tabacinus;* also the various parts of the spikelets are covered with a similar rusty-looking scurf, which is formed of small, dry scales carried upon a short pedicel or very short base: with age those scales fall off, while their bases, which are persistent, render the surface on which the scales rested minutely scabrous.

The appendicular parts of the spadices of the *Daemonorops*, although constructed on the same plan as those of the *Calami*, nevertheless present certain features proper to themselves: these will be described later.

VI.—The Spikelets.

The spikelets of *Daemonorops* differ greatly, as a general rule, in the sexes, and appear at a first glance to be, in almost every case, very different from those of the *Calami;* yet they are, as a fact, constructed on the same plan. I know only of two species (*D. verticillaris* and *D. geniculatus*) in which the male spikelets are indistinguishable from those of a *Calamus*, with comb-like spikelets, with close-set flowers, infundibuliform spathels and cupular involucres (Pl. II, f. 6). Also the male spikelets of *D. longispathus* greatly resemble those of the *Calami;* but generally the male spikelets of *Daemonorops* have a very slender axis, the spathels are reduced to mere scales, and the involucres are scarcely distinguishable; the male spikelets of all the species of the group of *D. Hystrix* and *D. Draco* have this structure. The male flowers on the axis of the above-described spikelets are moreover but rarely perfectly distichous, and they are not arranged in one plane; whereas the contrary is almost always the case in the *Calami.* The male spikelets of *D. longipes* recall those of certain *Gramineae.* In a very few cases (in *D. longispathus* and *D. ruptilis*) the female spikelets are, in their spathels and other involucres, extremely similar to those of a *Calamus;* but, as a rule, they differ greatly from the latter, so much so that several authors refuse to call them spikelets at all, but branchlets, on account of their spathels not being infundibuliform but resembling mere scales, and also because their involucrophorum is far more developed than in a *Calamus*, being often several millimetres in length, and thus forming a pedicel to the fruit, although it does not possess a very distinct limb (Pl. I, f. 1, 5, 7, *e*).

The involucre of the female flower is often formed by a kind of pedicel raised above the involucrophorum (Pl. I, f. 1, 7, *d*), and terminating in a flat, nearly circular superficies which is the scar left by the fallen flowers; this scar is surrounded only by an excessively narrow ridge in such a fashion that all the parts which should support the flowers seem to want every foliaceous appendicular part. This is very marked in the species of the groups of *D. Hystrix* and *D. mirabilis;* at times the involucre is evolved asymmetrically or unilaterally and assumes almost the shape of an ear, because the areola of the neutral flower is situated on the most developed side, and thus rendered very conspicuous; this occurs in *D. geniculatus, D. acanthobolus, D. scapigerus, D. periacanthus, D. longispathus.* The involucre of the female flower of *D. cristatus* is also singular, borne as it is in a strangely oblique manner by the involucrophorum, and then prolonged on one side at the margin into a kind of small pedicel, which carries the sterile flower.

The female spikelets of *D. ruptilis* have quadrifarious flowers, and the same may be said of *D. sparsiflorus;* but, in any case, the female flowers are bifarious and more or less distichous, though often with a tendency to be unilateral. The spathels are large, spathaceous and amplectent in *D. ruptilis,* and infundibuliform in *D. longispathus,* as in a typical *Calamus* (Pl. II, f. 8, 10). The involucrophorum has a pedicellar part and is infundibuliform in *D. ruptilis* (exactly as in a *Calamus);* in *D. Hystrix, D. Korthalsii,* and *D. Gaudichaudii* it is callous in the axilla; but in most of the *Daemonorops* the involucrophorum has lost its appendicular nature to assume the axial.

The involucre of the female spikelets, though in most *Daemonorops* it has a form peculiar to itself, is nevertheless in *D. longispathus* indistinguishable from that of a *Calamus,* and in *D. ruptilis* has, as in several *Calami,* a pedicellar and also an infundibular part. In *D. Treubianus, D. Sepal, D. pinangianus,* and *D. petiolaris* a small callosity is formed at the axil of the involucre together with the axis.

The areola of the sterile flowers (Pl. I, f. 1, 7, *d*; Pl. II, f. 8, 10, *e*) is found in *Daemonorops* as in *Calamus,* for as in the latter the female flowers are accompanied by a neuter or sterile flower. Only in *D. Kunstlerii* have I found no trace of an areola, the sterile flower being, as it would appear, also wanting. In certain species the areola is very indistinct, being represented by a small punctiform pit, while in other cases it is as clearly defined as in the *Calami.*

In the species of group of *D. Draco,* in *D. didymophyllus, D. Riedelianus, D. geniculatus, D. acanthobolus,* but especially in *D. longispathus,* the areola is ovate, and very clearly circumscribed by raised margins, just as in a typical *Calamus* (Pl. II, f. 8, 10, *e*). The shape of the areola in the species of the group *Cymbospatha* is also peculiar. In these the scar of the sterile flower is surrounded (though in the greater number on the upper side only) by a semi-circle (at times a double one) so tumescent as to simulate a nectary (Pl. I, f. 7, *d''*).

In *D. cristatus* a true areola is wanting, because a neutral flower is borne laterally upon a sub-pedicelliform prolongation of the margin of the involucre.

VII.—The Flower.

Neuter flowers.—Whenever the areola or simply a small cicatrix exists at the side of the involucre of the female spikelets, there also the neuter flower will be found (Pl. II, f. 8, *b*); but this latter being very fugacious, and detaching itself very easily, is very frequently absent from herbarium specimens.

In some cases the neuter flower, which is usually somewhat more slender than a female flower, from which it otherwise differs but slightly (Pl. II, f. 8, *b*), assumes considerable dimensions; thus in *D. stenophyllus* it measures 4—5 mm. in length, 5 mm. in *D. Pierreanus*, 6—7 mm. in *D. fissus*. I have never found expanded neuter flowers, which, it seems, do sometimes occur in the *Calami*. Yet it is not impossible that in certain cases the neuter flowers do expand, and may even have nectariferous organs within them. In *D. Kunstlerii* neuter flowers appear to be wanting, for the areola upon which such a flower should stand cannot be discovered.

Male flowers.—The male flowers of *Daemonorops* do not differ essentially from those of the *Calami;* they are always greatly elongated, have the calyx superficially 3-dentate, and the corolla twice or thrice the length of the calyx (Pl. II, f. 2, 4, 5). In two instances, in *D. verticillaris* and *D. longipes*, I have noticed nectariform bodies at the bases of the filaments of every stamen (Pl. II, f. 7).

Female flowers.—The female flowers of a *Daemonorops* are easily distinguished from those of a *Calamus*, for the former have an almost truncated calyx, superficially 3-dentate (then split into 3 pieces), and the corolla considerably longer than the calyx (Pl. I, f. 1-4; Pl. II, f. 1, 8, *a* and 9, 10); whereas in *Calamus* the calyx is deeply tri-lobed or trifid, and the corolla is about the same length as the calyx.

The female flowers of *Daemonorops*, like those of the *Calami*, have 6 sterile stamens, forming, with the bases of their filaments, which are joined together, a sort of membranous cup or cupula around the ovary, crowned by 6 points, each of which carries an abortive anther (Pl. I, f. 4). In *D. scapigerus* the staminal cupula, as the ovary develops, becomes detached from the thorum, but persists around the summit of the style on the top of the fruits, like a cylindrical hat.

The ovary of the female flower of *Daemonorops* in no wise differs from that of the *Calami*. In *D. Jenkinsianus*, where I have been able to study it preserved in alcohol, I have found it distinctly three-celled, these cells being throughout of equal size, while each is furnished with an ovule, to all appearance equally well shaped; soon, however, one of the ovules rapidly surpasses in development the other two, which become abortive (Pl. I, f. 5); however, cases in which two ovules are both transformed into seeds are, as in *Calamus*, by no means uncommon.

The ovules are set in the inner angle of the base of the cells; they are anatropous with the micropyle turned outwards, situated near the base, while the funiculus is very short.

VIII.—The Fruit.

The fruit of *Daemonorops* is extremely similar to that of several kinds of *Calamus*, but the seed has always a ruminate albumen, and a basal embryo. All the fruits of *Daemonorops* are constructed alike. I shall therefore describe only the fruit I have myself examined, namely, that of *D. Jenkinsianus* preserved in alcohol and received from Sikkim, through the kindness of Major Gage, Superintendent of the Botanical Garden of Calcutta (Pl. I, f. 9, 10). The pericarp of *D. Jenkinsianus*, like that of all the *Daemonorops*, is very thin; its most noticeable part is the epicarp, which, as in *Calamus*, is formed by the well-known imbricating scales, which constitute an effective protection for the seed. The mesocarp and the endocarp are scarcely to be distinguished from each other, but together they form a parenchymatic tissue barely 0·3 mm. in thickness, which consists of a few layers of very large and very thick-walled cells, traversed lengthwise by fibro-vascular bundles, amounting altogether, between small and great, to about forty in number.

There exists, moreover, an internal and very thin epiderm. On the removal of the seed several fibro-vascular bundles are readily detected within the concavity of the pericarp, for they stand out clearly like slender ribbons upon the surrounding tissue; they start from the base of the fruit at the point which corresponds to the apex of the perianth, and are reunited at the apex of the pericarpal cavity after having very slightly anastomosed with each other. The pericarpal cavity in the fruits preserved in alcohol is shiny, and is lined with a layer of a dark-coloured coagulated and gelatinous substance which presents no trace whatever of cellular structure. This layer of amorphous gelatinous substance between the walls of the pericarp and the seed forms a coating around the latter, which entirely enfolds it, and is extremely thin in certain parts, while in others it attains 0·5 to 0·6 mm. in thickness. This gelatinous substance, which gives a tannic reaction, appears to have accumulated in the interstices between the cells of the ovary by transudation from the canals interposed between the base of the ovule and the ligneous rings of the axial part that carries the fruit.

The seed has an integument of its own. This integument is fleshy and smooth externally; its thickness varies from 0·7—2 mm., being in most cases rather thicker on the side of the raphe than elsewhere. It is derived from the external wall of the ovule, and is formed of a parenchymatous tissue, soft and composed of rather large elements, elliptical in shape, and with their greater diameter transverse to the fruit and having thin walls. In a tissue composed of such cells, lysigenic cavities or sacs form, either spherical or elliptical in section, and filled with a mucilaginous substance which itself appears to be saturated with a tannic fluid. They are therefore tanniferous cavities of most variable dimensions, some indeed being very large. Those sacs which lie nearest to the periphery show through the excessively thin cellular exterior layer of the integument as dark dots (at least in the fruits preserved in alcohol); they are scattered here and there over its surface, and are plainly visible to the naked eye. Between the tissue enclosing the tanniferous cavities and the endosperm lies a tissue void of such cavities and formed of a few layers of cells which are also parenchymatic and thin-walled, and the longest diameter of which is normal to the endosperm. The endosperm is penetrated, especially in the uppermost portion, by deep, dark-coloured canals convergent on the centre. These canals are formed of cells, elongated in the direction of the canal itself, which are also saturated with a tannic substance, but which is, however, not collected in special cavities or sacs. Two or three layers of very small cells situated under the tissue in which the canals originate, or in immediate contact with the endosperm, constitute the testa of the seed.

The endosperm offers nothing remarkably different from that of a *Calamus*. It is horny or bony and perfectly solid even to the centre. From what has been stated above, it would seem that the rumination of the seed of the *Daemonorops* is not entirely due to the penetration of the outer integument within the endosperm, since the external tissue which penetrates into the canals does not appear to be derived from it, but from a layer of cells placed under the integument, a layer which belongs apparently only to the nucellus.

Together with the ripe fruits, I was able to examine also some ovaries of *D. Jenkinsianus* also preserved in alcohol, which had already attained a diameter of 4·5—5 mm. (Pl. I, f. 7, 8). In ovaries which have attained this degree of development, it is clearly seen that the gelatinous-tanniferous fluid, previously mentioned, transudes from the exceedingly acute angle formed by the insertion of the funiculus with the ovarian cavity, and accumulates unevenly around the ovule during its transformation into a seed. This uneven accumulation produces depressions here and there upon the surface of the young seed which vanish as the seed arrives at complete maturity.

In the ovule arrived at the degree of development just stated (*i.e.*, of 4—5 mm. diameter), there may be observed, in a longitudinal section following the raphe and passing by the micropyle (Pl. I, f. 8), a considerable cavity in the central part, of irregular shape (the embryo sac) which starts from the micropyle (Pl. I, f. 8), and extends in the direction of the periphery at the point which corresponds to the chalaza (Pl. I, f. 8, *g*); this cavity is lined with a delicate layer of endosperm in a state of formation, and its surface, at the point nearest to the chalaza, is rendered uneven by tiny protuberances which are no other than the beginnings of the canaliculi which will later bring about rumination.

Already at this stage of development, in the fleshy mass which later forms the integument of the seed, the tanniferous sacs can be seen in very considerable numbers. These sacs probably draw by endosmosis out of the mass the tannic substance which exudes between the ovule and the ovarian wall. The integument of the seed becomes, in the ripe fruit, fleshy and is frequently acidulate or sweetish.

IX.—The Seed.

The seeds of *Daemonorops* are for the most part globular, though often of irregular shape. When the integument (which, as it dries, adheres closely to the seed) is stripped off, the surface is seen to be finely pitted all over. These tiny openings indicate the beginnings of the canals, full of the tanniferous substance, which penetrate the interior, and are the cause of the rumination of the seed.

Sometimes the seed is more or less compressed or flattened, but more often it shows a prominence or swelling on the side of the raphe (*D. melanochaetes*, *D. Pierreanus*, *D. angustifolius*). In *Calamus* the depression of the chalaza or chalazian fovea, is very strongly marked on the raphal side, but in *Daemonorops* it is most often hardly to be made out, being quite superficial and punctiform; however, in the species belonging to the *D. Draco* group, it is indicated by a very narrow furrow. Only in the seeds of *D. Calapparius* among all those of the genus *Daemonorops* which I have cut open, have I found it very distinct, pit-like and running almost into the centre of the albumen. In *D. leptopus* the rumination of the seed is only very slightly marked. The embryo in *Daemonorops* is, without exception, basal or nearly so.

X.—Floral and extrafloral Nectaries.

As in *Calamus*, so in *Deamonorops*, one meets with organic parts which bear the appearance of extra-nuptial nectaries. Also in *Daemonorops* the aforesaid parts sometimes are more evident than in the other genus, although situated in the same places, namely, in the axilla of the leaflets, and at every division of the spadix at the junction of the branches and of the branchlets, as well as at the axilla of the appendicular organs of the spikelets. From observations subsequent to those published by me under *Calamus*, I have been enabled to observe how very numerous are the palms which exhibit tumefactions or callosities at the bases of the segments of pinnated fronds; these tumefactions are formed of a tissue which even on purely superficial examination, appears to differ entirely from that of the rachis and of the leaflets. In the palms most commonly cultivated in our gardens in Europe, such tumefactions are extremely plain in *Phoenix*, but they are so above all others in the *Cocos* of the *C. capitata* group, in which there exists, in the superior axil of the leaflets, and also in the hollow formed by the bending down of their limb on the under-surface, a fissure having more or less tumified edges of a light colour.

In *Gaussia splendens*, a Cuban palm, these callosities or tumefactions at the base of every segment are developed in a very unusual degree. In *Phloga polystachia* Noronha (*Dypsis nodifera* Mart.), a palm of Madagascar, the callosities in the axilla of the leaflets are very large, and appear to be frequently visited by certain insects which transform them into quite conspicuous galls.

In the *Cocos* mentioned, I have not observed that the callosities were ever visited by insects of any kind, nor have I ever noticed any nectar flowing out of the fissure; while, on the contrary, I have seen insects, and especially bees, in great numbers upon their flowers. It is therefore possible that those callosities of *Phoenix* and *Cocos* act in both cases purely as supports to their respective leaflets, but it is also possible that in certain palms they may act as lures to particular kinds of insects, such as ants, for I have observed that in *Phoenix sylvestris* and *Cocos capitata* and related species, many of the cells of which these callosities are composed are saturated with a saccharine fluid.

I have since been able to satisfy myself that the same thing occurs in the hard callosities found at the axils of the male spikelets in *D. verticillaris* which are only a repetition of those found at the axils at the insertions of all the branches and branchlets of this species, and in other species as well. In these axillary callosities it is easy, by means of Trommer's reagent (a solution of copper sulphate, copper and potassium hydrate) to discover in many cells of their substance, even when in a dried-up condition, the characteristic brick-red colouring of cuprous oxide. It seems therefore possible that, in certain palms, these callosities really act as nectaries, or at least as lures and baits for ants or other insects; while in the greater number of other species such a function is purely rudimentary. I have been able to recognize with absolute certainty the existence of true floral nectaries in the flowers of *Cocos capitata*, and in its allied species. It is, moreover, a well-known fact that the flowers of various kinds of palms, by their saccharine substances, do attract insects eager to feast on their sweetness. Among these insects are Cetoniides and Rhyncophora, and this fact in itself suffices to lead us to suppose the existence of a biological connection between such insects and the flowers of palms.

It would not therefore surprise me, if the flowers of certain *Daemonorops* (as of some *Calami*) were found to be more frequently nectariferous than is at present believed. I have however, as a fact, noticed true floral nectaries only in the flowers of *D. verticillaris*, and to a smaller degree in *D. longipes*, both of which species are of, all the *Daemonorops* and this is a coincidence well worth remembering the best provided with an apparatus capable of rendering service to and receiving service from ants, as I propose to explain more fully further on.

The organs which, in the two species just mentioned, seem to me to be real nectaries, consist of six fleshy, round, very small bodies, that alternate in the male flowers with the stamens in the throat of the corolla (Pl. II, f. 7, *g*). In addition, the infundibular part of the corolla of the same flowers below the throat, that is, below the point of insertion of the stamens and of the afore-mentioned small bodies, appears to be nectariferous.

XI.—Myrmecophilism.

The inflated spathes of *Daemonorops* of the division *Cymbospatha* have rather the appearance of organs intended for the reception of ants; though I must acknowledge as a fact that I have never perceived that they formed a permanent dwelling for these insects, perhaps because they are deciduous; yet almost all the *Cymbospatha* species are provided, at the axils of the involucres of the male flowers and in those of the involucrophorum of the female flowers, with a callous swelling, in appearance nectariform, which may indicate the existence of a biological connection between ants and this peculiar form of spathe. Also a peculiarly prominent callous and nectariform swelling is to be seen in the areola of the neutral flower of the greater number of the species belonging to the before-mentioned group around the point of insertion of the flower (Pl. I, f. 7, *d*); indeed very few of the *Cymbospathae* are without this tumescence, which may perhaps be regarded as an organ of the nature of a bait or lure, acting as such occasionally in some species, while in others it is simply representative. The semi-circular nectariform swelling around the areola of the neutral flower is exceedingly developed in *D. melanochaetes*, *D. Pierreanus*, *D. grandis*, *D. Kurzianus*, *D. angustifolius*, *D. trichrous*, *D. calicarpus*, *D. Sepal*, etc.

Myrmecophilism is far more accentuated in *Daemonorops* than in *Calamus*, and it is particularly easy of verification in *D. verticillaris*, *D. mirabilis* and related species, also in *D. formicarius*.

In the species of the group *Cymbospatha*, the spathes, as has been already said, would appear to have been specially modified to enable them to shelter ants, though I have never ascertained, as a positive fact, that these insects make use of these organs as a permanent residence. Nevertheless all the species belonging to this group are more or less favourites with ants, which very often accumulate small fragments of heterogeneous substances for building nests among the spines of the leaf-sheaths.

The biological connection between ants and the *Daemonorops* is very evident in *D. mirabilis*, in which species the leaf-sheaths are furnished all round with several completely closed circular galleries which are formed of pairs of membranous rings or collars, which are curved over in opposite directions, *i.e.*, in each pair one collar points upwards, the other downwards. The collars are also fringed with long slender spines, which completely close in the galleries in question. The ants, therefore, to get into these ready-made habitations, which are the result of so wonderful a transformation of the spines, are compelled to make an entrance for themselves, which they obtain by gnawing through the tissue of the membranous ring at some convenient point, in a way precisely similar to that in which the same insects pierce the ventricose ocrea of certain species of *Korthalsia*.

Galleries very similar to those of *D. mirabilis* are found in *D. verticillaris* and others of the same group; these are however less completely closed, and in these the ants contrive to make their abode by closing the interstices between the spines of the collars with small fragments of rubbish, always taking care to leave a way of access into the interior. But *D. verticillaris* has in addition to these ant-harbouring galleries and nectariform tumefactions at each ramification of the spadices and at the axils of the spikelets, special nectaries in the male flowers, as I have already mentioned, a state of things which would induce a suspicion that this particular species has biological relations with other insects as well as with ants. We are as yet but imperfectly acquainted with the *Daemonorops* belonging to the group of *D. mirabilis;* of very few have the flowers and fruits been thoroughly studied, yet it is certain that, in the species of this group, well-marked instances of mutual relations between them and ants are found to exist.

XII.—Uses of the Daemonorops.

The usefulness of *Daemonorops* is very nearly equal to that of the *Calami*, though the economic value of the latter is somewhat superior; but precise information in this respect is wanting, both *Calamus* and *Daemonorops* being classed together in commercial language under the common name of "rattan canes." Some *Daemonorops* in Borneo have stems of extraordinary toughness, *e.g.*, *D. oxycarpus* ("Rotang Mignac" of the Malays), but they lack a fine polished surface, and are therefore not sought after by traders, though much used in their native home. Yet species of *Daemonorops* are not wanting which supply canes not to be distinguished from the finest quality that *Calamus* can produce, and like these are objects of exportation; of such are said to be *D. Jenkinsianus*, from the north-east of India.

The bud shoots of *D. periacanthus* ("Rattan Manis"="sweet Rattan") are eatable, as are those of many other palms; but in most *Daemonorops* that part is bitter, as it is in *Calamus*. The involucre of the seed is pulpy, acidulate or sweetish, and refreshing in taste in many species, while the seed itself, which is ruminate and impregnated with tannin, can be used, before reaching complete maturity, as a substitute for the Areca nut.

But the most important produce of the *Daemonorops* is Dragon's Blood, called by the Malays "Djernang," which is furnished in abundance, and of the best quality, by *D. Draco*, *D. Draconcellus* and *D. propinquus*, perhaps also by *D. micranthus*, and in small quantity by *D. Motleyi;* a slight secretion of this drug also takes place from the fruits of *D. ruber* and *D. mattanensis*. It would appear that *D. Kurzianus* of the Andaman group, and *D. palembanicus* of Sumatra, also furnish "Djernang" in small quantities.

XIII.—Geographical Distribution.

The genus *Daemonorops* has a geographical distribution much more restricted than that of the genus *Calamus*, but like the latter is represented by species that in the great majority of instances have a very restricted geographical area, and grow most frequently mingled with *Calamus*, under identical physical conditions, in the great forests of the regions of the Monsoons in Southern Asia, in the Malayan Archipelago and in the Philippines.

The geographical area of *Daemonorops* is comprised between Lat. 10° S. and 25° N.; and between Long. 85° and 132° E. Graphically, the area occupied by this genus would be fairly well shown on a map by a large ellipse, the long axis of which of about 2,500 miles, stretching from the north-west to the south-east, would pass through the centre of Borneo, while its shorter axis, about 2,100 miles in length, stretching north-east and south-west, would touch the extreme northern point of Borneo.

Not only therefore are no *Daemonorops* to be found in Africa, but even in India they are not met with west of Bengal; hence no representatives of this genus are found in Western India, in the centre and south of the Indian Peninsula, nor in Ceylon.

The extreme eastern limit of *Daemonorops* is attained in the Aru Islands, where a form very closely related to the Javanese *D. melanochaetes* grows, which may be considered as the ultimate extension of that species eastwards, since the *Daemonorops* really appears to be wanting throughout New Guinea. The most northern species of *Daemonorops* is *D. Jenkinsianus*, at least we may so regard it, until the presence of a species related to *D. longipes*, collected by von Siebold

(Leiden Herbarium) in the Liu-kiu Islands, belonging to Japan, has been positively, proved. *D. Jenkinsianus* is also possibly the most western species, though to this species must be added *D. Manii* and *D. Kurzianus* (a form related to *D. Jenkinsianus*) of the Andaman Group. No representative of the genus *Daemonorops* is as yet known to exist in the Nicobar Islands, though it is not at all improbable that it may exist there. *Daemonorops* is therefore a genus essentially of the Indo-Malayan Region of Malaysia proper, and of the tropical Asiatic Archipelagos. Of the 83 species of *Dœmonorops* known at the present day, quite 30 inhabit the Malayan Peninsula and the small islands on its coasts, 26 are found in Borneo, and 15 in Sumatra. Next comes Celebes with 5 species; Java, the Moluccas, and the Philippines have 3 each, while the Andamans have two.

Northern India, Siam, Cochin-China, China and the Aru Group have each a single species. But this enumeration will be very soon altered, as most certainly a large number of new species of *Daemonorops* still remain to be discovered in the not yet botanically explored parts of Borneo, Sumatra and Celebess and in the Philippine and Sulu Archipelagos. Of the 30 species which inhabit the Malay Peninsula and its islands, 24 may be regarded as endemic, as far as we know at present, 4 (*D. propinquus, D. verticillaris, D. geniculatus* and *D. longipes*) are thought not to be such, only, however, because they also grow across the Straits, in the part of Sumatra nearest to the Peninsula. Only one, *D. periacanthus*, grows in Singapore, and on the neighbouring Continent; on the other hand, it is found unchanged in Borneo, Sumatra and Bangka. Of all the *Daemonorops* of the Malay Peninsula, this species possesses the widest geographical range. Of the 30 species proper to the flora of the Peninsula, *D. elongatus* and *D. Lewisianus* are found only in Penang, yet it may be taken for granted that future researches will tend to modify the delimitation of the areas of several species, for it is probable that others besides those mentioned, till now believed to be peculiar to the Malayan Peninsula, may be discovered in Sumatra and Borneo.

As with respect to other groups of plants, so also with *Daemonorops*, it has been observed that, notwithstanding the great affinity existing between the flora of the Malayan Peninsula and that of Borneo, the species, or nearly all the species, of *Daemonorops* growing in one of these regions differ from those growing in the other, though related among themselves; thus to *D. Draco, D. propinquus* and *D. micracanthus*—Peninsular species, correspond in Borneo *D.* and *Draconcellus D. mattanensis*; to the Malayan *D. Hystrix* correspond *D. oxycarpus* and *D. Korthalsii*; while to the Peninsular species with leaf-sheaths furnished with rings forming ant-harbouring galleries, such as *D. Sabut, D. oligophyllus,* and *D. macrophyllus*, Borneo opposes the related species *D. annulatus, D. collariferus* and *D. mirabilis*. A noteworthy fact is this, that about half of the 30 *Daemonorops* of the Malayan Peninsula belong to the *Cymbospatha* section, and are indigenous. No doubt the centre of formation of *Cymbospatha* is in the Peninsula of Malacca, but the original parent plant may have been *D. Jenkinsianus*, which from Sikkim worked its way through Assam and Burma in the shape of a peculiar form down into Tenasserim (var. *tenasserimicus*) and there, at the extreme point of the Malayan Peninsula, generated many other forms. From *D. Jenkinsianus*, on the one side, the forms found in Siam (*D. Schmidtianus*), in Cochin China (*D. Pierreanus*), in China (*D. Margaritae*), would appear to have come, and, on the other, the two found in the Andaman Group (*D. Manii* and *D. Kurzianus*). These latter again, by way of Sumatra, may have generated all the forms allied to *D. melanochaetes.*

India, properly so-called, possesses only the three species already mentioned, namely, *D. Jenkinsianus* in the North-East and *D. Kurzianus* and *D. Manii* in the Andamans, but reckoning the Malayan Peninsula flora as belonging to the Indian, then the total number of *Daemonorops* forming part of that flora amounts to 33 , of these only 4 or 5 are not endemic and quite 18 species rank as members of the *Cymbospatha* group. In Borneo the existence of 26 species of *Daemonorops* has been verified, of which 24 belong to the *Piptospatha* group, and only two to the *Cymbospatha* (typical), namely, *D. fissus* and *D. melanochaetes*, plus *D. ursinus*, which, however, constitutes a type quite peculiar to Borneo. Of the 24 Bornean *Piptospathae*, four (*D. Draconcellus*, *D. mattanensis*, *D. sparsiflorus* and *D. Motleyi*) belong to the *D. Draco* group ; five others (*D. oxycarpus*, *D. microstachys*, *D. elongatus*, *D. Korthalsii* and *D. vagans*) to that of *D. Hystrix*.

Seven or eight species of *Daemonorops*, especially those forming part of the *D. mirabilis* group, appear provided with a more or less perfect apparatus, intended to promote mutualism between them and certain kinds of ants. Of this number are *D. formicarius*, *D. mirabilis*, *D. annulatus*, *D. collariferus*, and in a lesser degree *D. crinitus*, *D. cristatus*, *D. acanthobolus*, and *D. scapigerus*. All the *Daemonorops* of Borneo are indigenous, save five, which are *D. melanochaetes*, *D. periacanthus*, *D. elongatus*, *D. vagans* and *D. didymophyllus*. The somewhat wide diffusion of *D. periacanthus* is very probably due to the greater facilities for dissemination it enjoys, being, as it is, a littoral species.

Next to the Malay Peninsula and Borneo in wealth of species ranks Sumatra with its 14 or 15 ; but, probably, in this great island, there exist several new species still awaiting discovery ; on the other hand, some of those indicated as Sumatran have been included in the list on very uncertain data.

Of the 14 *Daemonorops* proper to Sumatra, six species belong to *Cymbospatha*, and among these *D. melanochaetes* is the mostly widely diffused, and is represented under the most varied forms, or even as distinct yet closely allied species. Among the Sumatran *Cymbospathae* are some very characteristic forms, such as *D. stenophyllus* and *D. singalanus*. The latter however is not wanting in features of close analogy to *D. Sepal* of the Malayan Peninsula. There is also *D. trichrous*, which scarcely differs from *D. angustifolius* of the Malay Peninsula. Taken all together, Sumatra has fewer peculiar forms of *Daemonorops* than have Borneo and the Malayan Peninsula, since of the 14 or 15 species the presence of which appears to be authenticated, only half can be really held as indigenous; one, *D. periacanthus*, is also common to Borneo, Bangka and the Malayan Peninsula; two are said to have been found in Java also (*D. melanochaetes* and *D. oblongus*); and five others (*D. Hystrix*, *D. verticillaris*, *D. didymophyllus*, *D. longipes* and *D. geniculatus*) are also inhabitants of the Malayan Peninsula. Among the purely Sumatran species, two (*D. Forbesii* and *D. pseudo-mirabilis*) have the very closest affinity to some Bornean species.

The island of Bangka, the flora of which appears to have more affinity with that of Sumatra than with that of Java, possesses no indigenous forms of *Daemonorops* so far as is known at present, but it does possess some varieties or geographical forms of *D. melanochaetes*, a variety of *D. palembanicus* together with *D. trichrous* and *D. periacanthus*—also found in Sumatra, and *D. longipes*, which may be considered to be the most widely diffused species of the genus.

The five *Daemonorops* of Celebes are all endemic *Piptospathae*, but four of these (*D. macropterus*, *D. Sarasinorum*, *D. robustus*, *D. lamprolepis*) form a sub-group by themselves, characterized by the inner spathes extending only very slightly beyond the outermost; to this group belongs *D. niger*, a species proper to the Moluccas. The fifth Celebesian species (*D. Riedelianus*) is a typical *Piptospatha*.

The Philippine species of *Daemonorops* are seven in number; of these *D. Gaudichaudii* and *D. Curranii* are respectively related to *D. Riedelianus* from Celebes and *D. elongatus* from Borneo; *D. Loherianus* apparently belongs to a group of species peculiar to Celebes (*D. macropterus*, *D. lamprolepis*); *D. ochrolepis* and *D. Clemensianus* approach *D. Calapparius* of the Moluccas; *D. Margaritae* var. *palawanicus* is one of the forms referable to the polymorphic *D. melanochaetes*, and *D. virescens* is plainly derived from *D. longipes*; hence it is clear that the *Daemonorops* of the Philippines, although endemic, are derived from forms belonging to Celebes and the Moluccas. From all that has been stated, it is easy to deduce that the formative centre of the *Daemonorops* lies within the area in which the Malayan Peninsula, Borneo and Sumatra are included; and that thence certain species have spread out to the extreme limits of Malaysia, into Celebes, the Philippines, the Moluccas, to the Aru Group, into the Indo-Chinese Peninsula, and into the maritime tropical parts of China.

The division *Cymbospatha* has its principal focus in the Malayan Peninsula, whereas the greater number of *Piptospatha* species are found in Borneo. No *Cymbospatha* is known to exist in Celebes, in the Philippine Group proper, or in the Moluccas, and but one, as mentioned above, grows in Palawan. It follows therefore that the *Cymbospathae* constitute the most characteristic group of palms of the most central division of the Malayan flora. The greater number of *Daemonorops* prefer the low-lying forests near the coasts for their habitat. It is among these that the species with the widest geographical distribution are found; also it seems to be quite clear that it is from these littoral species that those others which have strayed farthest from the original centre of production derive their origin.

Thus *D. palembanicus* and *D. melanochaetes* may derive from *D. Manii* and *D. Kurzianus* of the Andaman Islands; while *D. aruensis* of the Aru Group is again derived from *D. melanochaetes*; *D. longipes* may have been the parent of *D. virescens* in the Philippines, and perhaps of another species also, which inhabits the most southern islands of the Japanese Group.

The *Daemonorops* do not appear to seek so high a mountain habitat as the *Calami*. *D. Jenkinsianus* is certainly a species which prefers mountainous regions, but it does not apparently attain any very great elevation either in the Himalayas or in Assam. Some species proper to the Malayan Peninsula (*D. monticolus*, *D. vagans* and

D. Kunstlerii) flourish on Mount Ophir and on the Gunong Tambang Batak, between 500 to 1,500 metres above the sea.

It seems that those species which show a predilection for high mountains have a tendency to shorten their stems and to lose their scandent character.

Generic differences between Daemonorops *and* Calamus.

DAEMONOROPS.	CALAMUS.
Leaf-sheaths—Never flagelliferous.	*Leaf-sheath*—Flagelliferous or not.
Ocrea—Always very short; only in *D. ursinus* it is prolonged into two long appendages.	*Ocrea*—Often greatly developed, at other times short.
Leaves—The upper always more or less cirriferous.	*Leaves*—Cirriferous in some whole groups, in others not.
Leaflets—Always narrow and acuminate; never rhomboidal nor premorse.	*Leaflets*—Variable.
Spathes—After flowering open, short cymbiform or flat, deciduous; never armed with claws.	*Spathes*—Always tubular and tight-sheathing; at least in their lower portions almost always more or less armed with claws.
Spadices—Form a panicle, mostly a very short one; no thorns on the axial parts.	*Spadices*—For the most part greatly elongated and flagelliferous; or if panicled, set with claws on the axial parts.
Spikelets—♂ very rarely comb-like, most having flowers imperfectly bifarious, with scale-like or bracteiform, not tubular spathels.	*Spikelets*—♂ almost always have perfectly bifarious flowers, and infundibular spathels.
Spikelets—♀ have almost always very short annular spathels. (In *D. longispathus* and *D. ruptilis* these are infundibular).	*Spikelets*—♀ have almost always infundibular spathels.
Involucrophorum—pedicelliform truncate, and almost without a limb; bears the involucre at its extremity.	*Involucrophorum*—Is either infundibular or cupular.
Involucre—Usually truncate, more rarely cupular.	*Involucre*—Cupular.
Flowers—With truncate or ± superficially 3-dentate calyx; corolla about twice as long as calyx.	*Flowers*—♀ with deeply tri-lobed or 3-partite calyx; corolla about the same length as calyx.
Seed—Always ruminate, has the foveola of the chalaza indistinct, pit-like, or reduced to a narrow fissure, very rarely taking the shape of a canal penetrating within the seed.	*Seed*—Mostly with the albumen homogeneous or with intrusions of the superficial integument; the foveola of the chalaza very distinct and deep. In relatively few species the seed is more or less deeply ruminate.
Embryo—Always basal.	*Embryo*—Most often basal, but sometimes lateral.

D. longispathus **and** ***D. ruptilis*** **are, perhaps, the species which approach nearest to** ***Calamus.***

General distribution of the species of Daemonorops.

		North-East India.	Burma.	Andamans.	Tenasserim.	Continental Malayan Peninsula.	Penang.	Singapore.	Siam.	Cochin-China.	China.	Philippines.	Borneo.	Sumatra.	Java.	Bangka.	Celebes.	Moluccas.	Aru Islands.
	CYMBOSPATHA.																		
1	D. Jenkinsianus (*Griff.*) *Mart* ...	+	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	,, ? *v.* tenasserimicus *Becc.*	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	D. Manii *Becc.*	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	D. melanochaetes *Bl.*	...	...	...	...	...	...	...	...	...	...	...	+?	+	+	+?	...	...	...
	,, *v.* microcarpus *T. & B.*	...	...	...	...	...	...	...	...	...	...	...	...	...	+?	...	...	...	...
	,, *v.* macrocymbus *Becc.*	...	...	...	...	...	...	...	...	...	...	...	...	...	+?	...	...	...	...
	,, *v.* padangensis *Becc.*	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...
	,, *v.* macrocarpus *Becc.*	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...
	,, ? *v.* depresse-globosus *T. & B.*	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...
4	D. aruensis *Becc.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+
5	D. palembanicus *Bl.*	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...
	,, bangkanus *Becc.* ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...
6	D. Schmidtianus *Becc.* ...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...
7	D. Pierreanus *Becc.*	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	...	...	...
8	D. Margaritae *Hance*	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	...	...
	,, *v.* palawanicus *Becc.*	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	...
9	D. grandis (*Griff.*) *Mart.* ...	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...
10	D. Kurzianus *Becc.*	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	D. malaccensis *Mart.* ...	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...
12	D. hygrophylus (*Griff.*) *Mart.* ..	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...
13	D. stenophyllus *Becc.* ...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...
14	D. fissus *Bl.*	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
	,, *v.* cinnamomeus *Becc.* ...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
15	D. Binnendijkii *Becc.* ...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...
16	D. augustifolius (*Griff.*) *Mart.* ...	...	...	...	...	+	...	+	...	...	...	...	...	...	...	...	...	...	...
17	D. trichrous *Miq.*	...	...	...	...	...	...	...	...	...	...	...	...	+	...	+	...	...	...
18	D. intermedius (*Griff.*) *Mart.* ..	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...
	,, *v.* nudinervis *Becc.* ...	...	...	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...
19	D. Treubianus *Becc.** ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	D. Sepal *Becc.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...
21	D. pseudo-sepal *Becc.* ...	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...
22	D. imbellis *Becc.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...
23	D. Scortechinii *Becc.* ...	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...
24	D. singalanus *Becc.*	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...

* The exact locality of this is unknown.

		North-East India.	Burma.	Andamans.	Tenasserim.	Continental Malayan Peninsula.	Penang.	Singapore.	Siam.	Cochin-China.	China.	Philippines.	Borneo.	Sumatra.	Java.	Bangka.	Celebes.	Moluccas.	Aru Islands.
	CYMBOSPATHA—*concluded.*																		
25	D. monticolus (*Griff.*) *Mart.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...
	„ v. pinangianus *Becc.*	...	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...
26	D. Lewisianus (*Griff.*) *Mart.*	...	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...
27	D. petiolaris (*Griff.*) *Mart.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...
28	D. microthamnus *Becc.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...
29	D. tabacinus *Becc.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	
30	D. calicarpus (*Griff.*) *Mart.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...
31	D. ursinus *Becc.*	...	...	...	...	...	...	...	...	...	...	...	+	...		...	...	...	...
	PIPTOSPATHA.																		
32	D. macropterus (*Miq.*) *Becc.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...
33	D. Sarasinorum *Warb.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...
34	D. robustus *Warb.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...
35	D. lamprolepis *Becc.*	...	...	...	...	...	...	...		...	...	...	...	...	...	...	+	...	...
36	D. niger (*Rumph*) *Bl.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...
37	D. Loherianus *Becc.*	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	...
38	D. Draco (*Rumph*) *Bl.*	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...
39	D. Draconcellus *Becc.*	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
40	D. micracanthus (*Griff.*) *Becc.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...		...	...
41	D. propinquus *Becc.*	...	...	...	...	+	+?	...	...	...	...	...	...	+	...	...	...	...	...
42	D. ruber (*Reinw.*) *Bl.*	...	...	...	...	...	...	...	...	...	...	...	...	...	+			...	...
43	D. mattanensis *Becc.*	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...		...	...
44	D. gracilipes (*Miq.*) *Becc.*	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...
45	D. Motleyi *Becc.*	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
46	D. didymophyllus *Becc.*	...	...	...	...	+	...	+	...	...	...	...	...	...	...	...	...	...	...
	„ v. borneensis *Becc.*	...	...	...	...	...	...	...	...	...	...	...	+		...	...	...	...	...
47	D. sparsiflorus *Becc.*	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
48	D. leptopus (*Griff.*) *Mart.*	...	...	...	...	+	...	+	...	...	...	...	...	...	...	...	...	...	...
49	D. oxycarpus *Becc.*	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
50	D. microstachys *Becc.*	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
51	D. Hystrix (*Griff.*) *Mart.*	...	...	...	...	+	...	+	...	...	...	...	...	+	...	...	...	...	...
52	D. elongatus *Bl.*	...	...	...	...	...	+	...	...	...	...	...	+	...	...	...	...	...	...
53	D. Curranii *Becc.*	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	...
54	D. oblongus (*Reinw.*) *Bl.*	...	...	...	...	...	...	...	...	...	...	...	...	+?	+	...	...	...	...
55	D. Korthalsii *Bl.*	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
56	D. Riedelianus (*Miq.*) *Becc.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...
57	D. Kunstlerii *Becc.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...

		North-East India.	Burma.	Andamans.	Tenasserim.	Continental Malayan Peninsula.	Penang.	Singapore.	Siam.	Cochin-China.	China.	Philippines.	Borneo.	Sumatra.	Java.	Bangka.	Celebes.	Moluccas.	Aru Islands.
	PIPTOSPATHA—*concluded.*																		
58	D. vagans *Becc.* ...	...	...	...	...	+	...	...	...	...	...	...	+	...	...	...	...	...	...
59	D. depressiusculus (*T. & B.*) *Becc.*	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...
60	D. Gaudichaudii *Mart.* ...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	...
61	D. ochrolepis *Becc.*	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	...
62	D. Clemensianus *Becc* ...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	...
63	D. Calapparius *Bl.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...
64	D. verticillaris (*Griff.*) *Mart.* ...	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...
65	D. formicarius *Becc.*	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
66	D. crinitus *Bl.*	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
67	D. annulatus *Becc.*	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
68	D. mirabilis *Mart.*	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
	,, *v.* oligocyclis *Becc.* ...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
69	D. pseudo-mirabilis *Becc.* ...	...	...	...	...	...	...	...	...	...	...	...	...	+?	...	...	...	...	...
70	D. Forbesii *Becc.*	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...
71	Sabut *Becc.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...
72	D. oligophyllus *Becc.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...
73	D. collariferus *Becc.*	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
74	D. macrophyllus *Becc.* ...	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...
75	D. geniculatus (*Griff.*) *Mart.* ...	...	...	...	...	+	+	...	...	...	...	...	...	...	...	...	...	...	...
76	D. cristatus *Becc.*	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
77	D. acanthobolus *Becc.* ...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
78	D. scapigerus *Becc.*	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
79	D. periacanthus *Miq.* ...	...	...	...	...	...	...	+	...	...	...	...	+	+?	...	...	...	...	...
80	D. virescens *Becc.*	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	...
81	D. longipes (*Griff.*) *Mart.* ...	...	...	...	.	+	...	+	...	...	...	...	...	+	..	+?		...	...
82	D. longispathus *Becc.* ...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
83	D. acamptostachys *Becc.* ...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
84	D. ruptilis (*Wendl.*) *Becc.* ...	...	...	...	...	...	.	...	...	...	...	...	+	...	...	...	...	...	...

Conspectus of the species of Daemonorops

NORTH-EAST INDIA.	NORTH BURMA.	TENASSERIM.	MALAYAN
			Continent.
D. Jenkinsianus.	D. Jenkinsianus.	D. Jenkinsianus? *var.* tenasserimicus.	D. grandis.
			D. malaccensis.
			D. hygrophylus.
			D. angustifolius.
			D. intermedius.
			D. Sepal.
			D. pseudo-sepal.
			D. imbellis.
			D. Scortechinii.
			D. monticolis.
			D. petiolaris.
			D. microthamnus.
			D. tabacinus.
			D. calicarpus.
			D. micracanthus.
			D. propinquus.
			D. didymophyllus.
			D. leptopus.
			D. Hystrix.
			D. Kunstlerii.
			D. vagans.
			D. verticillaris.
			D. Sabut.
			D. oligophyllus.
			D. macrophyllus.
			D. geniculatus.
			D. longipes.

in each of the principal Floras.

Peninsula.		Andamans.	Sumatra.
Penang.	Singapore.		
D. monticolus *var.* pinangianus.	D. angustifolius.	D. Manii.	D. melanochaetes *var.* padangensis.
D. Lewisianus.	D. intermedius *var.* nudinervis.	D. Kurzianus.	D. melanochaetes *var.* macrocarpus.
D. propinquus.	D. didymophyllus.		D. melanochaetes *var.* depresso-globosus.
D. elongatus.	D. leptopus.		D. palembanicus.
D. geniculatus.	D. Hystrix.		D. stenophyllus.
	D. dissitophyllus.		D. Binnendijkii
	D. longipes		D. trichrous.
			D. singalanus.
			D. Draco.
			D. propinquus.
			D. gracilipes.
			D. Hystrix. ?
			D. oblongus. ?
			D. depressiusculus.
			D. pseudo-mirabilis
			D. Forbesii.
			D. dissitophyllus. ?
			D. longipes.

Conspectus of the species of Daemonorops

JAVA.	BORNEO.	BANGKA.	SIAM.
D. melanochaetes.	?D. melanochaetes.	?D. melanochaetes.	D. Schmidtianus.
" v. macrocymbus.	D. fissus.	D. palembanicus *var.* bangkanus.	
" v. microcarpus.	" v. cinnamomeus.	D. trichrous.	
D. ruber.	D. ursinus.	D. longipes.	
D. oblongus.	D. Draconcellus.		
	D. mattanensis.		COCHIN-CHINA.
	D. Motleyi.		D. Pierreanus.
	D. didymophyllus *var.* borneensis.		
	D. sparsiflorus.		
	D. oxycarpus.		
	D. microstachys.		S. CHINA.
	D. elongatus.		D. Margaritae.
	D. Korthalsii.		
	D. vagans.		
	D. formicarius.		
	D. crinitus.		
	D. annulatus.		
	D. mirabilis.		
	D. " *var.* oligocyclis.		
	D. collariferus.		
	D. cristatus.		
	D. acanthobolus.		
	D. scapigerus.		
	D. dissitophyllus.		
	D. longispathus.		
	D. acamptostachys.		
	D. ruptilis.		

in each of the principal Floras.

ARU ISLANDS.	CELEBES.	MOLUCCAS.	PHILIPPINES.
D. aruensis.	D. macropterus.	D. niger.	D. Margaritae *var.* palawanicus.
	D. Sarasinorum.	D. Calapparius.	D. Loherianus.
	D. robustus.		D. Curranii.
	D. lamprolepis.		D. Gaudichaudii.
	D. Riedelianus.		D. ochrolepis.
			D. Clemensianus.
			D. virescens.

DAEMONOROPS BL.

Blume in Schultes Syst. Veg. vii, 1333, and Rumphia ii, pls. 131 to 137 and iii, 2, pls. 138 to 145, 163B.; Mart. Hist. Nat. Palm. iii, 203; Endl. Gen. n. 1736; Kunth 1, Enum. Pl. iii, 204; Miq. Fl. Ind. Bat. iii, 81; Becc. and Hook. f. in Hook. f. Fl. Brit. Ind. vi, 462; Becc. in Rec. Bot. Surv. Ind., ii, 218; Ridley, Mat. Fl. Mal. Penins. ii, 171.

Calami sp. Auct. pl.

Usually slender, climbing, more or less spinose or aculeate, polycarpic palms, never totally unarmed, rarely tufted or with an erect stem, never bearing terminal inflorescences. *Leaves* alternate, always pinnate, those of the upper part of the adult plant always cirriferous, the radical or those of young plants non-cirriferous *Leaflets* almost always narrow and elongate, rarely broadly lanceolate or oblong, never ovate or rhomboidal, with 1 or 3—very rarely more—bristly costae, always converging to an acuminate point, straight, never sigmoid. *Stem* with long internodes, covered at first with sheaths forming the basal portion of the leaves. *Leaf-sheaths* always complete and cylindraceous, very rarely shortly open at the apex on the ventral side, never flagelliferous. *Ocrea* usually short, rarely more or less elongate and hispid, or produced into two long appendages at the sides of the petiole. *Spadices* dioecious, never much elongated or flagelliform, always devoid of spines on the axial parts above the first spathe; never prolonged at the apex into a cirrus; before flowering usually fusiform or cylindraceous. *Spathes* at first cymbiform or cylindraceous, more or less covered externally with straight, never clawed spines; after the anthesis entirely split longitudinally or open flat and often deciduous; secondary spathes with an inconspicuous very short or subinfundibuliform limb. *Male spadix* in flower densely panicled in the section *Cymbospatha;* elongated, narrow and strict in *Piptospatha*, rarely diffuse. *Male spikelets* very seldom comb-like, usually with alternate sub-bifarious flowers, furnished with very small scale-like spathels and inconspicuous involucres. *Male flowers* solitary at every spathel; the calyx small, subcupular and three-dentate or even cylindraceous; corolla coriaceous, always considerably longer than the calyx, divided almost to the base into 3 segments; stamens 6. *Female spadix* panicled, often dense, or more or less diffuse; spikelets with the female flowers always accompanied by a sterile or neuter one, almost always with short annular spathels, very seldom infundibuliform. *Involucrophorum* pedicelliform, truncate and almost without a limb, and bearing the involucre at its summit. *Involucre* usually truncate or less often cupular. *Areola of the neuter flower* almost always distinct. *Female flowers* always a good deal larger than the male ones, ovoid; the calyx truncate or superficially 3-dentate; the corolla about twice as long as the calyx, its segments coriaceous; staminodes forming a cup crowned by 6 rudimentary anthers; ovary clothed with retrorse scales, 3-celled, with very thin, membranous and speedly obliterated dissepiments; style short or conical; stigmas 3, usually rather large, thickly subulate and internally lamellose; ovules 3, anatropous, basilar, erect. *Neuter flowers* usually smaller or at least more slender than the female ones, with well formed calyx and corolla and 6, usually sterile stamens and an abortive ovary. *Fruit* globose, ovoid or ellipsoid, more or less distinctly beaked and usually crowned by the recurved stigmas; pericarp thin, crustaceous, clothed with appressed, deflexed, imbricating, polished, hard scales. *Seed* solitary, globular or somewhat depressed, usually enveloped by a sweet, acidulous or mucilagineous integument, always more or less finely pitted; albumen deeply ruminated, its chalazal fovea usually indistinct and punctiform, sometimes represented by a narrow furrow, very seldom pit-like. *Embryo* always basal.

Geographical distribution.—North-East India, Burma and Malayan Peninsula, Andamans, Malayan Archipelago, Siam, Cochin-China, Lower China, Philippines, Aru Islands.

CONSPECTUS OF THE SPECIES ACCORDING TO THEIR REAL OR PRESUMED NATURAL AFFINITIES.

SECTION I.—CYMBOSPATHA.

Spadix (♂ and ♀) short, more or less fusiform and beaked before flowering, never much elongated; fruit-spadix short, densely paniculate; spathes papyraceous, the outermost inflated-ventricose, completely enwrapping the inner ones, concave-cymbiform when open, distinctly beaked, always more or less covered with laminar or slender and acicular spines.

* Leaf-sheaths not furnished with a distinct ocrea at their apex.

A. *Stem scandent.*

1. D. Jenkinsianus. 2. D. Manii. 3. D. melanochaetes. 4. D. aruensis 5. D. palembanicus. 6. D. Schmidtianus. 7. D. Pierreanus. 8. D. Margaritae. 9. D. grandis. 10. D. Kurzianus. 11. D. malaccensis. 12. D hygrophylus. 13. D. stenophyllus. 14. D. fissus. 15. D. Binnendijkii. 16. D. angustifolius. 17. D. trichrous. 18. D. intermedius. 19. D. Treubianus. 20. D. Sepal. 21. D. pseudo-sepal. 22. D. imbellis. 23. D. Scortechinii. 24. D. singalanus.

B. *Stem erect.*

25. D. monticolus. 26. D. Lewisianus. 27. D. petiolaris. 28. D. microthamnus. 29. D. tabacinus. 30. D. calicarpus.

** (Anomalous). Ocrea transformed into two very long stipuliform appendages at the sides of the petiole.

31. D. ursinus.

Section II.—Piptospatha.

Spadix (♂ and ♀) elongated, narrowly cylindraceous before flowering, then more or less diffusedly branched. Outer spathe not completely enclosing the inner ones and not contracted at the apex into an elongated beak.

A. *Leaf-sheaths armed with isolated or confluent spines, not with annular spiculiferous crests. Primary spathes of male and female spadices coriaceous, tubular before the anthesis, afterwards open flat. Male flowering panicle very narrow, strict, cupressiform.*

1. Spathes narrow and long, produced at the apex into a tail-like bristly tip; the inner ones usually shortly protruding beyond the outermost; the latter covered with slender acicular spines. (In *D. Loherianus* the outer spathe is a good deal shorter than the others, as in the following group.) Mouth of the leaf-sheaths not armed with unusually long erect spines.

32. *D. macropterus.* 33. *D. Sarasinorum.* 34. *D. robustus.* 35. *D. lamprolepis.* 36. *D. niger.* 37. *D. Loherianus.*

2. Spathes thickly coriaceous, the outermost usually armed with short, stout, digitate spines, and shorter than the inner ones, which gradually and conspicuously rise above the ones below. (In *D. Motleyi* and *D. didymophyllus* the inner spathes very shortly protrude beyond the outer ones.)

† Mouth of the leaf-sheaths smooth or armed with not very long scattered spines pointing variously.

⊙ Fruit resiniferous (very slightly in *D. gracilipes*).

38. *D. Draco.* 39. *D. Draconcellus.* 40. *D. micracanthus.* 41. *D. propinquus.* 42. *D. ruber.* 43. *D. mattanensis.* 44. *D. gracilipes.* 45. *D. Motleyi.* 46. *D. didymophyllus.* 47. *D. sparsiflorus* (Nos. 46 and especially 47 somewhat aberrant in the group).

⊙⊙ Fruit not resiniferous.

48. *D. leptopus.* 49. *D. oxycarpus.*

†† Mouth of the leaf-sheaths usually armed with long flat and broad erect spines. Fruit never resiniferous.

⊙ Seed with an inconspicuous punctiform superficial chalaza.

50. *D. microstachys.* 51. *D. Hystrix.* 52. *D. elongatus.* 53. *D. Curranii.* 54. *D. oblongus.* 55. *D. Korthalsii.* 56. *D. Riedelianus.* 57. *D. Kunstlerii.* 58. *D. vagans.* 59. *D. depressiusculus.* 60. *D. Gaudichaudii.* 61. *D. ochrolepis.* 62. *D. Clemensianus.*

⊙ Seed with a deep pit-like chalaza.

63. *D. Calapparius.*

B. *Leaf-sheaths furnished with spines or stiff bristles united by their bases into laminar crests or complete annular membranous collars or rings.*

1. Leaf-sheaths with complete annular horizontal collars.

64. *D. verticillaris.* 65. *D. formicarius.* 66. *D. crinitus.* 67. *D. annulatus.* 68. *D. mirabilis.* 69. *D. pseudo-mirabilis.* 70. *D. Forbesii.* 71. *D. Sabut.* 72. *D. oligophyllus.* 73. *D. collariferus.* 74. *D. macrophyllus.*

2. Leaf-sheaths with oblique spinulose membranous crests only.

75. *D. geniculatus.* 76. *D. cristatus.* 77. *D. acanthobolus.* 78. *D. scapigerus.*

C. *Leaf-sheaths armed with isolated or confluent spines, not with annular crests Spadix (♂ and ♀) elongate-paniculate when in flower. Primary spathes elongate-lanceolate when open, thinly coriaceous or papyraceous; the outermost with two dorsal smooth or spinulose keels.* (In *D. acamptostachys* the primary spathes are unknown.)

79. *D. periacanthus.* 80. *D. virescens.* 81. *D. longipes.* 82. *D. longispathus.* 83. *D. acamptostachys.* 84. *D. ruptilis.*

KEY TO THE SPECIES OF THE SECTION CYMBOSPATHA.***

I. Leaf-sheaths not furnished with a distinct ocrea at their apex.

A.—Stem climbing.

(*a*) *Spadices sessile or very shortly stalked.*

a. Leaflets linear or linear-ensiform, usually not more than 15—20 mm. in width.

1. Spadices before flowering narrowed into a beak at least as long as the body.

§ Outer spathe covered with long very slender criniform spiculae.

* Spiculae scattered, not entirely covering the surface of the outer spathe.

*** A very well characterised group on the whole, composed of several species, many of which are very difficult to distinguish from one another, especially Nos. 1 to 8. which may be considered as sub-species of a collective species or "synspecies" of which *D. Jenkinsianus* may be assumed as the prototype. Also the speecies of subgroup B with erect stem (Nos. 25—31) are very difficult to discriminate on account of the insompleteness of Herbarium specimens. They afford no very conspicuous diagnostic characters and are all closely related species.

Pedicellar part of the spadix prickly. Fruit with 18 continuous longitudinal furrows, from the scales being uniformly furrowed throughout their length. Seed globular, slightly depressed.

1. D. Jenkinsianus.

Pedicellar part of the spadix smooth; scales with a longitudinal furrow, deeper near the base than at the apex.

2. D. Manii.

** Spiculae entirely covering the surface of the outer spathe.

Seed globular, strongly ventricose on the the raphal side.

3. D. melanochaetes.

Seed globular, somewhat depressed and almost equally convex on both surfaces.

4. D. aruensis.

§§ Outer spathe densely covered with long and narrow laminar spines. Seed globular, ventricose on the raphal side.

5. D. palembanicus.

2. Spadices before flowering with a beak shorter than the body.

Leaflets of the cirriferous leaves linear-lanceolate, broadest about their middle. Areola of the neuter flower depressed, slightly tumescent. Fruit 18—20 mm. in diameter.

6. D. Schmidtianus.

Leaflets linear-ensiform, broadest a little above the base. Beak of the second spathe as long as one-third of its entire length and armed with long laminar spines. Involucrophorum pedicelliform. Areola of the neuter flower sub-orbicular, tumescent. Fruit 16–17 mm. in diameter.

7. D. Pierreanus.

Leaflets linear-ensiform, broadest a little above the base. Outer spathe very shortly beaked, armed with laminar often laciniate spines. Petiole and rachis very densely prickly above. Involucrophorum bracteiform, sessile.

8. D. Margaritae.

β. Leaflets ensiform, comparatively broad, at least more than 2 cm. in width.

Leaflets not very closely set, not bristly on the upper surface, margins smooth. Outer spathe armed with broadly laminar spines, that are distinctly callous above at the base. Seed irregularly globose.

9. D. grandis.

Leaflets closely set, bearing long bristles on 3 nerves above, margins closely spinulous. Outer spathe armed with large flat spines often confluent by their bases and almost pectinate. Seed orbicular, flattened.

10. D. Kurzianus.

Leaflets very closely set, rather large (50—52 cm. long, 2—5 cm. broad); first and second spathe armed on the body and on the beak almost to the apex with very long narrowly laminar or sub-setiform spines.

11. D. malaccensis.

γ. Leaflets very narrow, 15—17 mm. in width at most, very regularly and very closely set (about 10—15 mm. apart).

1. Outer spathe armed with short rigid triangular spines.

12. D. hygrophylus.

2. Outer spathe armed with broad, elongated, flat, elastic, often laciniate spines.

§ Leaves of the upper and fertile part of the plant almost without a petiolar part. Spathes with deeply laciniate spines. Scales of the fruit straw coloured.

13. D. stenophyllus.

§§ Leaves of the upper and fertile part of the plant with a more or less elongate petiole.

* Fruit globular but conically beaked; its scales of a uniform cinnamon-brown colour.

14. D. fissus.

** Fruit scales usually with a darker or discoloured margin and a black apex and often with a light speck behind the apex. Leaflets very narrow, very closely set at a very wide angle.

Outer spathe armed with broadly laminar, strongly laciniate spines. Second spathe unarmed.

15. D. Binnendijkii.

Outer spathe rather gradually narrowing into the beak, armed with long laminar usually not laciniate spines. Second spathe unarmed or nearly so. Fruit-scales not spotted at the apex.

16. D. angustifolius.

Outer spathe as in the preceding. Second spathe rather densely spinous. Fruit-scales blackish at the apex with an intra-marginal light spot.

17. D. trichrous.

δ. Leaflets ensiform, opaque, comparatively broad (2—3·5 cm. broad, 30—35 cm. long), remotely equidistant, 3—5 cm. apart.

18. D. intermedius.

(*b*) *Spadices more or less stalked by a slender pedicellar part, erect.*

Petioles in the leaves of the upper part of the plant very long, smooth on the upper surface, plano-convex. Leaflets narrowly linear. Beak of the outer spathe furnished with long sub-bristly spines at its base.

19. D. Treubianus.

Petioles rather short, biconvex. Leaflets of the leaves of the upper part of the plant rather short, linear-lanceolate, broadest about their middle. Fruit ovoid-ellipsoid, 24—25 mm. long, 14—15 mm. broad, its scales alutaceous.

20. D. Sepal.

Petiole of the leaves of the upper and fertile part of the plant very long, flattened sub-biconvex; leaflets linear. Fruit spherical, about 18 mm. in diameter; its scales straw-coloured.

21. D. pseudo-sepal.

(*c*) *Spadices furnished with a more or less elongate pedicellar part, nodding or recurved.*

Spadix nodding, the pedicel about 6 cm. long. Fruit large, 3 cm. long, ellipsoid.

22. D. imbellis.

Spadix nodding; the pedicellar part about 4 cm. long. Fruit spherical, about 2 cm. in diameter.

23. D. Scortechinii.

Spadix with a long pedicellar part recurved when in fruit; the latter globular-subturbinate.

24. D. singalanus.

B. Stem erect. Radical leaves very different from the upper ones, not cirriferous, with a long terete petiole. Upper leaves with a plano-convex petiole, usually short or almost obsolete.

(*a*) *Spadices rather distant one from the other.*

Outer spathe acutely two-keeled. Fruit globular conically beaked.

25. D. monticolus.

Outer spathe faintly two-keeled. Fruit spherical, mucronate.

D. monticolus var. *pinangianus*.

(*b*) *Spadices crowded to the summit of the plant.*

a Spadix when unopened shortly beaked.

Leaf-sheaths about 3 cm. in diameter, armed with flat, scattered or seriate spines. Leaflets of radical leaves not distinctly 3-costulate. The beak of the outer spathe forming the third or fourth part of the entire spadix.

26. *D. Lewisianus*.

Leaf-sheaths 15—20 mm. in diameter, armed with solitary or seriate but individually distinct spines. Rachis of the leaves of the upper part of the plant armed on the lower surface with digitate claws; leaflets of the radical leaves distinctly 3-costulate.

27. *D. petiolaris*.

Leaf-sheaths about 10 mm. in diameter, very sparingly armed with solitary spines. Leaves of the upper part of the plant very small, 15—18 cm. long, inclusive of a very short cirrus; their rachis armed on the lower surface with solitary, almost straight claws.

28. *D. microthamnus*.

β. Spadix when unopened long or moderately beaked.

Spadix ventricose, fusiform, suddenly narrowing into a beak as long as or longer than the body. Outer spathe armed with very many narrowly laminar spines. Leaf-sheaths armed with seriate individually distinct spines.

29. *D. tabacinus*.

Spadix fusiform, moderately beaked. Outer spathe entirely covered with criniform crispate spiculae. Leaf-sheaths armed with approximate whorls of spines confluent by their bases.

30. *D. calicarpus*.

II. Anomalous. Leaf-sheaths with the ocrea transformed into two very long stipuliform appendages at the sides of the petiole.

31. *D. ursinus*.

KEY TO THE SPECIES OF THE SECTION PIPTOSPATHA.

A. Leaf-sheaths armed with isolated or confluent spines, not with annular crests. Spathes coriaceous, tubular before the anthesis, then open flat. Male flowering panicle very narrow, strict, cupressiform.

I. Spathes coriaceous, tubular before flowering, produced at the apex into a tail-like bristly tip. Outer spathe in the unopened spadices almost entirely enclosing all the others (in *D. Loherianus*, each gradually longer than that immediately below.) Mouth of the leaf-sheaths not armed with very long erect spines, or quite smooth.

a. Outer spathe slightly shorter than the inner ones.

* Leaf-sheaths very densely armed with robust spines. (Leaf-sheaths unknown in *D. robustus.*)

Leaf-sheaths strongly armed with very robust large and unequal laminar spines. Fruit ellipsoid, with yellowish green scales.

32. D. macropterus.

Leaf-sheaths entirely covered with narrow very long needle-like spines. Fruit unknown.

33. D. Sarasinorum.

Leaf-sheaths . . . . Fruit spherical with greenish and yellow scales.

34. D. robustus.

** Leaf-sheaths armed with scattered slender flabby spines.

Fruit ellipsoid with yellowish green shining scales.

35. D. lamprolepis.

Fruit roundish, with reddish brown scales.

36. D. niger.

b. Outer spathe in the unopened spadix considerably shorter than the inner ones (as in the species of the group of *D. Hystrix*).

Mouth of the leaf-sheaths quite smooth. Male flowers very long and narrow, their calyx elongated, tubular, the corolla 3 times as long as the calyx.

37. D. Loherianus.

II. Outer spathe of the unopened spadix considerably shorter than the inner ones and terminating in a triangular often bidentate point. (In *D. Motleyi* and *D. didymophyllus* the inner spathes slightly protrude beyond those immediately below).

(*a*) Mouth of the leaf-sheaths smooth, or armed with spines variously directed.

* Fruit resiniferous.

† Leaf-sheaths armed with feeble, acicular, deciduous spines. Dragon-blood secretion very abundant.

Leaf-sheaths armed with slender feeble seriate spines. Leaflets linear-lanceolate, 30 cm. long, 2 cm. broad, bristly on 3 nerves on both surfaces. Fruit ovoid, shortly beaked or mammillate. Seed somewhat flattened, ovoid.

38. *D. Draco.*

Leaf-sheaths armed with feeble, seriate, easily deciduous spines. Leaflets very narrow (7—9 mm. in width), smooth above, and with 3 bristly nerves beneath.

39. *D. Draconcellus.*

Leaf-sheaths armed with numerous, very slender, often seriate, easily deciduous spiculae, resting on bulbous permanent bases. Leaflets linear–lanceolate, finely and closely ciliate on 3 nerves on both surfaces.

40. *D. micracanthus.*

†† Leaf-sheaths armed with rather strong permanent spines, of which some at least are flat and elongate.

§ Female spikelets with bifarious flowers.

⊙ Leaflets equidistant or nearly so, never geminate.

+ Scandent.

Leaflets with 3 bristly spinulous nerves on the upper surface and the mid-costa alone bristly beneath. Fruit strongly resiniferous, ovoid-pyriform or with a broad base and a more or less conical apex. Seed conical.

41. *D. propinquus.*

Leaf-sheaths with 3 bristly nerves on the upper surface. Fruit spherical, comparatively large, sparingly resiniferous.

42. *D. ruber.*

Leaflets not bristly on the upper surface, or only very slightly on the mid-costa. Fruit broadly ovoid with a broad base, slightly resiniferous.

43. *D. mattanensis.*

++ Not scandent.

Fruit very slightly resiniferous. Leaflets sub-unequidistant, but not regularly geminate.

44. D. gracilipes.

⊙⊙ Leaflets distinctly grouped or geminate.

Outer spathe elongate-fusiform, almost entirely enclosing the inner ones. Fruit ovoid with a broad base abundantly resiniferous.

45. D. Motleyi.

Spathes deeply and broadly spoon-shaped, each slightly protruding beyond that immediately below. Fruit broadly ovoid, slightly resiniferous.

46. D. didymophyllus.

§ § Female spikelets with spirally set flowers.

Leaflets equidistant, linear, with bristles on 3 nerves above and only on the mid-costa beneath. Female flowers with a very slender involucrophorum. (A very peculiar species of doubtful position, its fruit being unknown.)

47. D. sparsiflorus.

* * Fruit not resiniferous.

Leaf-sheaths woody, very hard, armed with robust rather short spines. Fruit small, ovoid-elliptical with a round base.

48. D. leptopus.

Leaf-sheaths armed with thinly laminar, sub-foliaceous, laciniate spines. Fruit narrowly elliptical, acute at both ends.

49. D. oxycarpus.

(*b*) Mouth of the leaf-sheaths more or less armed with flat long erect spines. Fruit never resiniferous.

* Fruit ovoid or oblong.

† Stem short, erect.

Spadix a small dense panicle on a slender, very long, peduncular part.

50. D. microstachys.

†† Stem scandent.

§ Fruit elongate ovoid, or globular-ovoid.

Leaflets equidistant, closely ciliate on 5 nerves beneath. Scales in 15 series.

51. D. Hystrix.

Leaf-sheaths armed with scattered laminar spines. Leaflets inequidistant, closely ciliate on the mid-costa alone. Fruit ovoid; scales in 12 series.

52. *D. elongatus.*

Leaf-sheaths armed with seriate, very slender spiculae. Leaflets equidistant, bristly on 3—5 nerves on the upper surface, and only on the mid-costa beneath. Fruit globular or shortly ovoid.

53. *D. Curranii.*

§ § Fruit oblong, about twice as long again as broad.

Leaflets sparsely bristly ciliate on 5 nerves beneath.

54. *D. oblongus.*

Leaflets very finely and closely ciliate on 5—7 nerves beneath.

55. *D. Korthalsii.*

* * Fruit spherical, or more or less depressed.

† Leaflets with 3 bristly and 2 spinulous nerves on the under-surface. Fruit globular, umbonate, 13 mm. in diameter.

56. *D. Riedelianus.*

† † Leaflets with only the mid-costa bristly underneath.

§ Stem erect.

Fruit spherical, 16—17 mm. in diameter. Scales in 18 longitudinal series. Areola of the neuter flower indistinct.

57. *D. Kunstlerii.*

§ § Stem scandent.

⊙ Areola of the neuter flower punctiform or indistinct.

Fruit spherical or slightly depressed, 14–15 mm. in diameter. Scales in 15 longitudinal sereis.

58. *D. vagans.*

Fruit globose, conspicuously depressed and umbonate at the apex, 12–13 mm. in diameter. Seed flattened, reniform. Leaflets with the mid-costa sparsely bristly underneath.

59. *D. depressiusculus.*

⊙ Areola of the neuter flower conspicuous, niche-like.

† Seed with a superficial inconspicuous (not pit-like) chalaza.

Fruit globular, slightly depressed when quite mature, usually 15–16 mm. in diameter, rarely more. Seed globular, about 12 mm. in diameter. Leaflets linear-ensiform or linear-lanceolate, usually 16—22 mm. broad, having bristles on 3 nerves on the upper surface.

60. *D. Gaudichaudii*

Fruit large, spherical, 20 mm. in diam. Leaflets with the mid-costa alone sparsely bristly above.

61. D. ochrolepis.

Fruit spherical, large, 22—24 mm. in diam. Leaflets narrowly ensiform, 13—15 mm. broad, spinulous on 3 nerves above and bristly on the mid-costa alone beneath.

62. D. Clemensianus.

† † Seed with a deep pit-like chalazal fovea.

Fruit spherical, large, 22—28 mm. in diam. Leaflets with very long bristles on 3 nerves above.

63. D. Calapparius.

B. Leaf-sheaths with spines united by their bases into laminar crests, or complete annular collars or rings.

† Leaf-sheaths furnished with complete horizontal collars.

a. Leaflets numerous, equidistant.

Collars membranous, fringed with large, flat, 4—6 cm. long spines and with several minute spiculae between them. Leaflets linear-lanceolate. Female spadix rather large, much branched. Fruit small, spherical. Rather robust.

64. D. verticillaris.

Collars with very long spadiceous capillary spiculae. Spadax small short, with very few branches. Slender.

65. D. formicarius.

b. Leaflets not very numerous, inequidistant but not distinctly grouped.

Collars with very long, black, capillary spiculae. Leaflets quite smooth on both surfaces, linear-lanceolate, broadest about their middle slender.

66. D. crinitus.

c. Leaflets distinctly grouped.

* Leaf-sheaths with one or more completely closed, hollow, annular galleries formed by pairs of equally large opposite collars, of which one points upwards and the other downwards.

Sheathed stem 15—16 mm. in diameter with 2—3 complete galleries, each formed by 2 opposite equal collars; base of the petiole smooth. Leaflets about 19, in 3 almost equal groups.

67. D. annulatus.

Sheathed stem 2·5—3 cm. in diameter. Leaf-sheaths furnished with 5—6 galleries or pairs of complete collars.

68. *D. mirabilis.*

Stem more slender than in the type and leaf-sheaths with only one pair of complete collars.

D. mirabilis var. *oligocyclis.*

** Leaf-sheaths furnished with unequal pairs of collars.

† Leaf-sheaths furnished with pairs of collars of which one points upwards and the other downwards, but the lower one much smaller than the upper.

Sheathed stem about 2 cm. in diameter. Leaf-sheaths furnished with several pairs of unequal collars. Leaflets with 3 slightly spinulous nerves on the upper surface, smooth beneath.

69. *D. pseudo-mirabilis.*

Sheathed stem about 12 mm. in diameter. Leaf-sheaths with 1—2 pairs of collars. Leaflets sparingly spinulous on 3 nerves on the upper surface and bristly spinulous on 5 nerves beneath.

70. *D. Forbesii.*

†† Leaf-sheaths furnished with reversed collars only.

§ Leaflets approximate into a few groups, 3-costulate.

Leaflets approximate in 4 groups of about 8 each, with 3 nerves on the upper surface and the mid-costa beneath bristly. Leaf-sheaths bristly spinulous at the mouth.

71. *D. Sabut.*

Leaflets 10—12 on the whole, approximate into 2-3 groups, bristly on the mid-costa on the upper surface, smooth beneath. Leaf-sheaths smooth at the mouth.

72. *D. oligophyllus.*

Leaflets about 40 on the whole, approximate into 5-6 groups, quite smooth on both surfaces or with the mid-costa alone slightly spinulous on the upper surface. The base of the petiole armed with very long (as much as 5—9 cm.) needle-like spines.

73. *D. collariferus.*

§§ Leaflets very few (2 pairs only in one specimen) large, lanceolate, with 3—8 slender costae, smooth on both surfaces.

74. D. macrophyllus.

(*b*) Leaf-sheaths furnished with simple oblique, membranous, spinulose crests.

a. Leaflets distinctly grouped.

Primary spathes with tufts of bristles on two dorsal carinae. Male spikelets pectinate. The axis of the ♀ spikelets strongly sinuous.

75. D. geniculatus.

b. Leaflets equidistant.

* Leaf-sheaths furnished with a few short simple spiculiferous crests on the ventral side.

Outer spathe papyraceous, unarmed. Male spikelets pectinate.

76. D. cristatus.

** Leaf-sheaths furnished with several, simple, oblique, semi-circular, annular spiculiferous crests.

Outer spathe furnished with long seriate hairs on the back. Female spadix elongate, panicled, much branched. Petiole armed with extraordinarily long spines at the sides.

77. D. acanthobolus.

Outer spathe smooth. Female spadix composed of a very short few-branched panicle on a long slender peduncular part.

78. D. scapigerus.

C. Leaf-sheaths armed with isolated or confluent spines, not with annular crests. Spadix (♂ and ♀) loosely paniculate when in flower. Spathes elongate-lanceolate when open, thinly coriaceous; the outer one with two dorsal smooth or spinulose keels.

I. Spathels of the female spikelets bracteiform, with a very short tubular part, or very shortly and broadly infundibuliform. Involucrophorum obconic, more or less pedicelliform.

a. Leaflets very distinctly grouped into several remote groups. Peduncular part of the spadix prickly at the sides.

Fruit spherical, with finely fringed scales.

79. D. periacanthus.

b. Leaflets more or less inequidistant, but not distinctly grouped. Peduncular part of the spadix flattened, unarmed.

Leaflets 2·5—3 cm. broad. Fruit ellipsoid-ovoid, 25 mm. long, 16—17 mm. broad; scales in 18 longitudinal series, each series composed of 11—12.

80. D. virescens.

Leaflets 20—28 mm. broad. Fruit 20—23 mm. long, 12—15 mm. broad. Scales in 15 longitudinal series, each series composed of 7—8.

81. D. longipes.

II. Spikelets (♂ and ♀) furnished with distinctly infundibular and closely approximated spathels. Involucrophorum spathaceous.

a. Female spikelets with bifarious flowers. Spathels of the ♀ spikelets entire or nearly so, truncate, shorter than the flowers.

Female spadix large, much branched and diffuse.

82. D. longispathus.

Female spadix very rigid, strict, cupressiform.

83. D. acamptostachys.

b. Female spikelets very thick, often with 4-farious flowers. Spathels of ♀ spikelets very large, longer than their respective flowers and more or less split.

84. D. ruptilis.

DETAILED DESCRIPTIONS OF SPECIES.

DAEMONOROPS BL.

1. **DAEMONOROPS JENKINSIANUS** Mart. Hist. Nat. Palm. iii, 327, t. z xviii, f. v and t. z xxi. f. 1 and t. z xxii. f. xi and expl. of the plates in Intr. p. clxiii; Walp. Ann. iii, 475 and v, 827; Hook. f. Fl. Brit. Ind. vi. 462; Becc. in Rec. Bot. Surv. Ind. ii, 218.

Calamus Jenkinsianus Griff. in Calc. Journ. Nat. Hist. v, 81, and Palms Brit. Ind., 89 (excl. fruit and t. clxxxvi, A, f. III = *C. Flagellum*); T. Anderson in Journ. Linn. Soc. xi, (1869) 11; H. Wendl. in Kerch. Palms. 236.

Calamus nutantiflorus Griff. in Calc. Journ. Nat. Hist. v, 79, and Palms Brit. Ind., 88, f. ccviii.

Daemonorops nutantiflorus Mart. Hist. Nat. Palm. iii, 326; Walp. Ann. iii, 474, and v, 827.

Calamus extensus Roxb. Fl. Ind. iii, 777?

DESCRIPTION.—High scandent, rather large. *Sheathed stem* 3—4 cm., the canes about 1·5–2·5 cm. in diameter; the internodes 15-20 cm. long, obsoletely longitudinally striate and with a vernicose surface. *Leaf-sheaths* (of the upper cirriferous leaves) gibbous above, more or less covered with a brown furfuraceous coating, armed, more or less densely, with thinly laminar, elastic, chestnut-brown or blackish, 3-4 cm. long, scattered, or confluent and seriate, spreading or deflexed, sometimes laciniate spines, mixed with many others smaller and more slender. *Radical leaves* not cirriferous, with their sheath gradually narrowing into the petiole; the latter elongate and deeply channelled above. *Leaves* of the upper part of the plant about 2 m. long in the pinniferous part, and terminating in a long and robust, strongly clawed cirrus; petiole furfuraceous at first, later glabrous, 10-20 cm. long, about 15 mm. broad, flat or slightly convex above, where more or less prickly at least near the margins; convex beneath where also more or less sparsely armed (at least near the margins) with, irregular, short, straight spines and furnished also along the centre of the dorsum with small solitary remote claws, which become stronger, closer, 2-3-nate on the rachis, and finally 5-nate or $\frac{1}{2}$-$\frac{3}{4}$-whorled on the cirrus; in the intermediate portion, the rachis is roundish or obsoletely angular, sparsely prickly on its upper surface, which only near its apex is naked and convex-bifacial; leaflets numerous, closely set, equidistant, alternate or sub-opposite, papyraceous, subconcolorous on both surfaces, very narrowly ensiform, very gradually acuminate to a subulate and setiform point, and in the lower part rather suddenly narrowing towards an acute base; on the upper surface the mid-costa is slender, but acute and sprinkled from the middle upwards with long brown bristles; on each side of the mid-costa there is usually one, but occasionally two, rather slender nerves that are also equally bristly from near their base at distances of

2-4 cm.; the under-surface is usually quite smooth or with only a few straggling bristles on the superficial mid-costa; the margins are closely and spreadingly bristly spinulous; the largest leaflets, those a little above the base, are usually 40-50 cm. and in vigorous specimens up to 50-70 cm. long, and 20-22 mm. broad; those near the apex are gradually smaller and the ultimate ones rudimentary. *Spadices* (♂ and ♀) sub-axillary or inserted far below the mouth of their sheath, not very broadly fusiform before flowering, erect, with a stout 3-6 cm. long and more or less densely prickly peduncular part; first or outermost spathe not very deeply concave-cymbiform, lanceolate, very gradually narrowing to a long beak, reddish or rusty brown, long persistent and marcescent, acutely two-keeled on the dorsum, more or less furfuraceous and, except at the sides, covered, usually very densely, with fuscescent or spadiceous, shining, needle-like or even bristly spines, which vary from a few millimeters to 3 cm. in length and spread in different ways; they have a bulbous base and are solitary or even fascicled, but never seriate; the beak is almost as long as the body and unarmed; inner spathes lanceolate-acuminate, very slightly concave or almost flat, of a cinnamon brown colour when dry, thickishly papyraceous, spreading during the anthesis, deciduous; the second spathe bearing sometimes a few needle-like spines on the two superficial dorsal keels; the others quite unarmed, glabrous inside, where of a darker colour than externally. *Male spadix* 60-80 cm. long (including the beak) before the opening of the spathes, cupressiform during the anthesis, ultra-decompound, with 5-6 erect, appressed and approximate branches or partial inflorescences; the secondary axial parts more or less densely and deciduously rusty-furfuraceous; the internodes of the main axis 2-3 cm. long, obsoletely flattened, rather slender and very slightly swollen at the junctures; each branch forms by itself an ovate, densely flowered panicle, 10-15 cm. long, covered in every part with a rusty-furfuraceous scurf, very shortly stalked and divided again into numerous erect-patent secondary branchlets which bear sub-distichously or slightly unilaterally 10-15 erect appressed spikelets and on the whole form small cupressiform secondary partial inflorescences; secondary and tertiary spathes with a very short, membraneous, sub-bracteiform, incompletely embracing limb and suddenly prolonged at one side into a subulate ciliate point. The largest spikelets (the lowest of each branchlet) 2-3 cm. long, with a rigid, slender, zigzag sinuous axis and with 4-6 distichous flowers on each side; the upper spikelets gradually shorter and with fewer flowers; spathels with a short membranous bracteiform limb and prolonged at one side into a subulate bristly penicillate point; involucre scarious, cupular, truncate, sub-bidentate and with two small brushes of small cilia on the side next to the axis. *Male flowers* erect, oblong, obtusely trigonous, often slightly asymmetric, 4·5-5 mm. long, 2-2·5 mm. broad and slightly narrowing towards the apex, not very acute; the calyx campanulate, very superficially 3-toothed, each tooth with a small tuft of rusty hairs at its apex, and with 3 groups of 9 strong veins outside, each group converging to one of the teeth; the corolla twice as long as the calyx, parted down almost to the base into 3 coriaceous, oblong-lanceolate, externally finely striate segments; filaments of the stamens subulate, shortly cohering and thickened at the base, slightly inflected at the apex; anthers linear, versatile, obtuse at the apex, attached about midway, with cells a good deal disjoined; rudimentary ovary very small, hidden amongst the bases of the filaments.

Female spadix, when with the spathes, very similar to the male one, but usually smaller, 50-60 cm. long; the flowering panicle alone 20-27 cm. in length, simply decompound, with 5-6 main branches or partial inflorescences; when in flower on the whole cupressiform; when in fruit forming a dense thyrsoid-ovoid panicle, the branches at first furfuraceous, later glabrescent, shortly and stoutly stalked, the uppermost alone provided with a rather long peduncular part; all bearing many erecto-patent spikelets, which have a rigid zigzag sinuous axis; the lower spikelets of each branch, the largest, 7-8 cm. long, with 6-7 alternately distichous flowers on each side, the upper ones gradually shorter and with fewer flowers; the internodes of the main axis obsoletely angular, 3-4 cm. long, not or very slightly swollen at their base; the internodes of the spikelets between two flowers are 4-5 mm. long, cylindraceous, slightly swollen at their base; spathels bracteiform with a very short scarious and at one side apiculate limb; involucrophorum pedicelliform, 2-3 mm. long, cylindraceous or obsoletely angular, slightly callous at its axis, broadened at the apex into a short oblique limb; involucre cupular, often somewhat obliquely truncate, obsoletely 3-denticulate, slightly raised above the involucrophorum, strongly striately veined outside; areola of the neuter flower rather small with a slightly tumescent semicircle above the scar. *Female flowers* ovate, 5-5·5 mm. long; the calyx campanulate, truncate, very distinctly and strongly veined; the corolla twice as long as the calyx, divided from a little above the base into 3 narrow, lanceolate, acuminate segments which remain erect and only slightly open divaricate during the anthesis; staminal urceolum crowned by 6 short suddenly apiculate teeth; anthers effete, sagittate, a good deal shorter than the lobes of the corolla; ovary ovate-globular; style stout, short; stigmata subulate, papillose-lamellose on the inner side, spreading horizontally amongst the segments of the corolla during the anthesis. *Fruiting perianth* persistent, not quite explanate under the fruit, the calyx being slightly convex and callous at the base. *Fruit* spherical, very shortly umbonate-mucronulate, 15-18 mm. in diameter; scales in 18 longitudinal series, deeply and narrowly channelled throughout along their centre line, the fruit appearing therefore very distinctly marked by 18 longitudinal narrow furrows; the scales are straw-yellowish or yellowish-brown, with a very narrow and inconspicuous darker intra-marginal line and a lighter erosely-toothed margin, rhomboid, as long as broad, with an obtuse not produced and not spotted apex. *Seed* erect, sub-spherical, very slightly flattened, not ventricose on the raphal side, 13 mm. in diameter, 10 mm. thick, with a granular and minutely pitted surface, the small pits corresponding to narrow channels which are filled with a dark sub-resinous stuff and penetrate two-thirds of the albumen, rendering the otherwise horny albumen ruminate; embryo basal near the scar of the insertion of the seed.

HABITAT.—North-East India and Upper Burma. Sikkim Himalaya (*Prain* in Herb. Beccari); Chittagong Hills (*Gamble* in Herb. Beccari; *Hooker f. & Thomson* in Herb. Kew.; *Burkill* No. 21023 in Herb. Calcutta.); Dulka Jahr in the Terai (*T. Anderson*, *Gamble* in Herb. Beccari); Western Duars at Chekopara and at Buxa Reserve (*Gamble*); Jalpaiguri and Kurseong (*Burkill* in Herb. Calcutta.). In Cachar at Shapore (*Keenan* in Herb. Kew.); Sylhet (*Hooker f. & Thomson* in Herb. Kew. and *C. B. Clarke* in Herb. Beccari); Assam (*Griffith* in Herb. Kew.); Khasia Hills (*Hooker f. & Thomson* in Herb. Kew.).

According to Anderson (l. c.) the fruit is mature in December in the Dulka Jahr, whence the canes are exported to the districts of Dinajpur and Maldah.

Vernacular name "Gallak Bet" in Chittagong; "Garra" and "Cheka Bet" in Jalpaiguri; "Dudhia Bet" at Kursong, according to Burkill.

OBSERVATIONS.—This, like all the other species of the group, is somewhat variable. It is rather closely related to *D. Manii*, *D. Melanochaetes* and other allied species, but is distinguishable chiefly by the fruit which is conspicuously marked with 18 narrow and deep longitudinal furrows; by the spadices which before flowering are narrowly fusiform-elongate with the outer spathe armed with acicular spiculae and the beak smooth; it is distinguished also by the inner spathes being without spines and slightly concave or almost flat. It varies a good deal in the degree of spinescence of the outer spathe. In the specimens from Sylhet, collected by Hooker f. and Thomson, the spines of the outer spathe are almost always solitary, less laminar and narrower than in the specimens coming from Assam and the Khasia Hills.

The fruit described by Griffith and figured in Pl. CLXXXVI, A, f. III of the "Palms of British India" as that of *C. Jenkinsianus*, is doubtless that of *C. Flagellum.*

Calamus nutantiflorus Griff. is certainly identical with *Daemonorops Jenkinsianus.* I have seen portions of Griffith's type specimen of it in the Herbaria of Kew and Calcutta.

In a male spadix of Griffith's specimen of *D. Jenkinsianus* in the Calcutta Herbarium, I have observed at the apex of the spikelets, charged with normal male flowers 1—2 flowers with a well developed ovary and therefore apparently hermaphrodite.

PLATE 1.—Daemonorops Jenkinsianus *Mart.* Spadix with perfectly mature fruits; female spadix in flower with the spathes *in situ;* an intermediate portion of a leaf; portion of a leaf-sheath with the base of the petiole. From a plant cultivated at Buitenzorg and introduced from Sikkim (Herb. Beccari).

DAEMONOROPS JENKINSIANUS Mart.? *var.* TENASSERIMICUS Becc.

DESCRIPTION.—Apparently of middling size. *Leaf-sheaths* armed with rather long laminar, blackish, very subulate, unequal, 2·5 cm. long or less, scattered or subseriat spines *Leaves* (apparently those of the lower part of the plant and not cirriferous) with numerous, equidistant, elongate-ensiform leaflets, which are green on both surfaces and have on the upper surface the mid-costa bristly-spinulous near the apex, and one slender nerve on each side of it, furnished with long spadiceous bristles; margins closely ciliate, spinulous. *Male spadix* with a very short prickly pedicellar part; outer spathe fusiform or elongate-cymbiform, narrowing gradually from a little above the middle to the beak, the whole 45 cm. long in one specimen, armed rather densely up to the base of the beak with usually scattered spines, which all point upwards, are erecto-patent, rather dark, thinly laminar, subulate, and rather short, usually only 10–15 mm. long; the second spathe is entirely covered like the first with a thin dark scurf and has a few slender spiculae along the not very prominent carinae. *Male flowers* small, 4–5 mm. long at most *Female spadix* glabrous in every part, erect, rigid, subsessile, forming, when in fruit, a dense thyrsoid-ovoid panicle, 20–35 cm. long, with the basal internodes of the main axis short and thick (2–4 cm. in length, 8–12 mm. thick) tumescent or swollen at the joints; primary branches 12–15 cm. long; lower spikelets of each branch (the largest) 6–8 cm. long with a rigid zig-zag sinuous axis, and with 6–8 distichously arranged flowers on each side; the internodes or spaces between two flowers 3–6 mm. long, cylindraceous or obsoletely angular; spathels with a short annular membranous limb prolonged at one side into a triangular point; involucrophorum pedicelliform, in the lower part of the spikelet up to 4–5 mm. in length, in the remainder shorter, always longer than its spathels, slightly obconical and gradually expanded into an oblique and at one side acute bracteiform limb, rather distinctly callous in its axilla; involucre shallowly but almost regularly cupular, entire, truncate; areola of the neuter flower distinct bordered above with a conspicuous swollen semicircular ridge. *Female flowers* oblong, 6 mm. in length; the calyx cyathiform-truncate, then split into three parts, strongly veined externally; the corolla twice as long as the calyx. *Fruiting perianth* almost entirely explanate, but the calyx has a very short base. *Fruit* globose, 17 mm. in diameter, very suddenly and distinctly beaked; scales in 20–23 longitudinal series, not very deeply channelled along the centre, pale brown with a faint darker intra-marginal line and a scarious, very finely erosely toothed margin. *Seed* globular, 11 mm. in diameter (not quite mature).

HABITAT.—Burma. Fruiting specimens at Zadi in Tenasserim and at Thaungyan (*Burkill* in Herbarium of the Reporter on Economic Products to the Government of India). Vern. name at Zadi "Thwon Kyeen," at Thaungyan "Kyein Phan". I consider as conspecific a male spadix also sent to me by Mr. I. H. Burkill with the No. 29378 from Tavoy, South Tenasserim. The same number however is appended to specimens of a *Plectocomiopsis.*

OBSERVATIONS.—I have seen of this only very fragmentary specimens. It differs from the typical *D. Jenkinsianus* in that the male spadix with the outer spathe is more deeply cymbiform, is armed with spines narrowly but distinctly laminar (not bristle-like); in the scales being in 20—23 series (not in 18); in the internodes of the fruit-spadix being swollen at their base, and in the areola of the neuter flower being more distinctly bordered by a swollen ring. It must be compared also with *D. Manii.* To this species are perhaps to be referred some fragmentary specimens collected by Helfer in the Mergui Province (Herb. Kew.).

2. DAEMONOROPS MANII Becc. in Hook. f. Fl. Brit. Ind. vi, 463, and in Rec. Bot. Surv. Ind. ii, 219.

DESCRIPTION.—High scandent and of moderate size. *Leaf-sheaths* . . . . *Leaves* (of the upper part of the plant) 1·5–1·75 m. long in the pinniferous part (in two leaves), and ending in a long, strongly clawed cirrus; petiole 25–30 cm. long, about 15 mm. broad, flat or slightly convex and smooth above (in two specimens), with divergent, straight, unequal spines at the margins, convex beneath and armed along the centre of the dorsum with solitary claws, which at rather regular distances of 3–4 cm. become on the rachis at first 2-nate and higher up 3-nate, and $\frac{1}{2}$–$\frac{3}{4}$-whorled on the cirrus; the rachis is very sparingly prickly above only in its first portion, otherwise smooth, obsoletely angular in the intermediate portion, convex-bifacial above from the middle upwards; leaflets numerous, closely set, equidistant alternate or sub-opposite, papyraceous, sub-concolorous on both surfaces, very narrowly ensiform, very gradually acuminate to a subulate and setiform point, and rather suddenly narrowing in their lower part to an acute base; on the upper surface the mid-costa is slender but acute, sprinkled from the middle upwards with long light-brown bristles and accompanied, on each side, with a slender nerve which is also equally bristly from near its base, at distances of 1–2 cm.; the under surface is usually quite smooth or with only a few straggling bristles on the superficial mid-costa; the margins are closely and spreadingly bristly-spinulous; the largest leaflets, those a little above the base, 25–30 cm. long, 12–15 mm. broad; those near the apex gradually smaller, and the ultimate ones rudimentary. *Male spadix* . . . . *Female spadix* apparently very narrowly fusiform before flowering, erect, with a rigid short (2–3 cm. long), unarmed (or almost so) peduncular part; first or outermost spathe completely enclosing the inner ones, not very deeply concave-cymbiform, very narrowly lanceolate, 50 cm. long (in one specimen) and very gradually narrowing into a long beak, thinly coriaceous, exsuccous, scaly-furfuraceous, long persistent and marcescent, acutely 2-keeled on the dorsum, 2 cm. broad between the two keels, and in this part only armed not very densely, with flat, elastic, 1–2 cm. long, solitary and scattered spines; the beak almost as long as the body and unarmed; inner spathes lanceolate-acuminate, very slightly concave or almost flat, all unarmed; the axial part of the spadix 15–28 cm. long, simply decompound, cupressiform on the whole, with 4–5 erect branches or partial inflorescences; the latter glabrous, shortly and stoutly stalked, the uppermost alone provided with a rather long peduncular part; the lower branches, which are the largest, 8–10 cm. long, with 5–8 spikelets; the latter with a rigid, rather thick, zig-zag sinuous axis; the largest of them, the lowest, 2–4 cm. long with only 3–4 flowers on each side; the internodes of the main axis obsoletely angular, 3–4 cm. long, not or very slightly swollen at their bases; the internodes of the partial inflorescences also obsoletely angular, 7–10 mm. long, not or very slightly swollen at their bases; the internodes of the spikelets (the spaces between two flowers) 3–6 mm. long; spathels bracteiform with a very short scarious and unilaterally apiculate or even acuminate limb; involucrophorum pedicelliform, 2–3 mm. long, cylindraceous or obsoletely angular, slightly callous at its axil, broadened at the apex into a short, oblique and at one side acute limb; involucre cupular, truncate, entire or very obsoletely 3-denticulate, slightly raised above the involucrophorum; areola of the neuter flower not very conspicuous, very slightly tumescent. *Female flowers* apparently not differing from those of *D. Jenkinsianus*. *Fruiting perianth* persistent, not quite explanate under the fruit, the calyx being slightly convex and callous at the base. *Fruit* spherical, very shortly umbonate-mucronulate, crowned by the small recurved stigmas, 15–18 mm. in diameter; scales in 18 longitudinal series, more deeply and broadly channelled along the centre of the posticous part than at the apex, polished, brownish, very slightly darker near the margin which is very narrowly scarious and very finely erosely toothed; the apex obtuse and not spotted. *Seed* globular, slightly flattened, not ventricose on the raphal side; embryo basilar, slightly to one side.

HABITAT.—Andaman Islands. Native name "Châng"; the leaves used for thatching huts. Collected by E. H. Man.

OBSERVATIONS.—I have seen of this two entire leaves, wanting however their sheath, an entire spadix with nearly mature fruit and two smaller and younger fruiting spadices. It is doubtless very closely related to *D. Jenkinsianus*, of which perhaps it is a geographical form, differing only in the narrower and more elongated outer spathe, in the smooth peduncular part of the spadix, and in the fruit which does not appear so regularly deeply longitudinally furrowed, the furrow on the dorsum of every fruit-scale being deeper and broader on its posticous part than at its apex The general dimensions of the plant seem smaller than those of *D. Jenkinsianus*, but the fruit is larger. The naked canes sent to me as those of the leafy and fruiting specimens described above are 12–15 mm. in diameter with the internodes 15–20 cm. long; they have a dull surface and a rather distinct longitudinal costa.

PLATE 2.—Daemonorops Manii *Becc.* The type specimen in Herb. Beccari.

2. DAEMONOROPS MELANOCHAETES Bl. in Roem. et Schult. Syst. Veget. vii, 2, p. 1333, obs. 1 (excl. syn.); Mart. Hist. Nat. Palm. iii, 198 (1st edit.), 203 (2nd edit.) and 326, pl. 117 and pl. 125, 1; Kunth, Enum. Pl. iii 202; Bl. Rumphia, iii, 3, pl. 134 and 137; Hassk. Tijdschr. Nat. Gesch. ii, 175; Miq. in Pl. Jungh. i, 161, and Fl. Ind. Bat. iii, 86; Walp. Ann. iii, 475, and v, 827; Teysm. Cat. Hort. Bog. 74; Becc. in Rec. Bot. Surv. Ind. ii, 219.

Calamus melanochaetes Miq., De Palm. Arc. Ind. 28; H. Wendl. in Kerch. Palm. 237; Griff. in Calc. Journ. Nat. Hist. v, 86, and Palms Brit. India, 92 (excl. *Palmijuncus niger* Rumph. and *Calamus niger* Willd.).

DESCRIPTION.—High scandent, of moderate size or rather robust. *Leaf-sheaths* armed with flat, schistaceous or blackish, long or short, more or less seriate spines. *Leaves* large; petiole robust, 15–40 cm. long, 15–25 mm. broad, more or less prickly above, especially near the margins; leaflets very numerous, equidistant, linear-ensiform, the intermediate ones 30–60 cm. long, 15–28 mm. broad, their mid-costa and one slender costula on each side of it bristly on the upper surface; on the under surface naked, or more or less bristly on the mid-costa alone; margins closely ciliate, spinulous. *Spadices* (♂ and ♀) rather broadly- or ventricose-fusiform, erect, subsessile or with a very short prickly peduncular part; outer spathes deeply concave-cymbiform, covered with many, solitary, long, very slender and sub-bristly spadiceous spines, which often have a paler tip; the beak as long, longer, or even shorter than the body, unarmed except at the base; inner spathes also deeply concave, thinly papyraceous, the second alone more or less spinous. *Male spadix* when in flower thyrsoid-cupressiform, with 5–8 partial inflorescences. *Male flowers* oblong and with nearly parallel sides, 5 mm. long, obtuse. *Female spadix* with the internodes of the main axis short, not swollen at the junctures. *Involucrophorum* with an oblique limb; involucre shallowly cupular, entire; areola of the neuter flower very distinct and tumescent. *Fruiting perianth* entirely explanate. *Fruit* spherical, shortly or very shortly umbonate-mucronate, 18–20 mm. in diameter, scales broadly and rather deeply channelled, brownish with darker intra-marginal line and an obtuse tip. *Seed* irregularly globular, gibbous on the raphal side, broader than long.

HABITAT.—The typical form of *D. melanochaetes* must be considered the one growing in the west part of Java, where it receives the names of "Rotang Selang," "Hoo Selan, Sellang o Seël." Apparently it does not differ from the type, one specimen in the Paris Herbarium, with an incomplete male spadix, which was collected by Hombron during the voyage of the French corvettes "L'Astrolabe" and "La Zélée" at Tanjong Selatan in the south-east end of Borneo. They may be considered as belonging to peculiar varieties of this species, some specimens coming from Sumatra and probably also from Bangka. In Java itself the species seems extremely polymorphic, judging at least from the numerous specimens I have received from Dr. Treub, that were cultivated in the Botanic Garden of Buitenzorg.

OBSERVATIONS.—I have given a very comprehensive description of this species as it is extremely variable. The typical forms are distinguishable from the allied species chiefly by the outer spathe being densely covered with innumerable, very slender, long, setiform or sub-bristly, often partially discoloured, not seriate spines; in some specimens however these spines have a tendency to broaden, and to lose their setiform appearance.

We may consider as belonging to the "forma typica" those plants that are of moderate size with the spadices not extraordinarily large, of which the outer spathe is densely clothed with subcriniform spines, have a spherical fruit 18–20 mm. in diameter, and the segments not or very scantily bristly-spinulous on the mid-costa beneath, and with the margins appressedly bristly-spinulous.

PLATE 3.—Daemonorops melanochaetes *Bl.* A spadix not yet open on the left hand side; fruiting spadix; intermediate portion of a leaf; portion of a leaf-sheath with the base of the petiole. From a plant cultivated at Buitenzorg in Herb. Beccari.

The following principal varieties may be distinguished:—

DAEMONOROPS MELANOCHAETES var. MICROCARPUS Teijsm. et Binn. Cat. Hort. Bogor. 74; Becc. in Rec. Bot. Surv. Ind. ii, 219.

DESCRIPTION.—Smaller. *Sheathed stem* 2·5 cm. in diameter. *Leaf-sheaths* lightly and partially covered with a thin dark furfuraceous scurf. *Leaves* about 2 m. long in the pinniferous part; their rachis smooth or slightly spinulous on its upper angle; leaflets 30–40 cm. long, 15–18 mm. broad, naked or very sparingly bristly on the mid-costa beneath, the margins sometimes sub-spreadingly ciliate-spinulous; spadices before flowering 10–30 cm. long in the ventricose part, the beak about as long as the body. *Fruit* apparently smaller than in type, but not seen by me.

HABITAT.—I have received this variety from the Botanic Garden of Buitenzorg, where it is cultivated under the name mentioned above. Very probably it is indigenous in Java. Another specimen, which I refer to the same variety, bears the Javanese name of "Rotang Sellang kechil" or the small "R. Sellang."

DAEMONOROPS MELANOCHAETES var. MACROCYMBUS Becc. in Rec. Bot. Surv. Ind. ii, 219.

DESCRIPTION.—Robust. *Sheathed stem* 5 cm. in diameter. *Leaves* 3·3-4 m. long (not including the cirrus); leaflets 50–60 cm. long, 2·5–3 cm. broad. *Male spadix* with the outer spathe sometimes 80—90 cm. long and 10–12 cm. broad in the ventricose part, very densely covered with innumerable long and very slender criniform spines. The beak comparatively short, about one-third the length of the body.

HABITAT.—I know this form, which probably is indigenous to Java, only from male specimens cultivated in the Botanic Garden of Buitenzorg.

PLATE 4.—Daemonorops melanochaetes *Bl.* The two small spadices on the right side of the plate are of the var. *microcarpus;* the other two figures are of the variety *macrocymbus;* that in the centre represents the upper portion of a male spadix during the anthesis; the other the back of the outer spathe. From plants cultivated at Buitenzorg, in Herb. Beccari.

DAEMONOROPS MELANOCHAETES var. PADANGENSIS Becc.

DESCRIPTION.—Rather robust. *Leaf-sheaths* armed with unequal spines, many of them with a large base and broadly laminar, interruptedly seriate and often laciniate. *Leaves* 3 m. long in the pinniferous part; rachis strongly spinulous on its upper angle; leaflet 30–45 cm. long, 15–20 mm. broad (the intermediate ones), with long light-brown bristles on 3 nerves above; underneath the mid-costa very closely and finely bristly; margins finely and closely ciliate with rather spreading sub-spinescent hairs. *Female spadix* before flowering clothed, not very densely, with very narrowly laminar or even sub-setiform seriate spines; the beak about half as long as the body. *Involucre* of the female flowers very shallow; areola of the neuter flower with a conspicuous semi-annular swollen callus on its upper side. *Fruit* spherical, very shortly conically beaked, scales with a distinct dark-coloured marginal line; not very deeply channelled along the middle.

HABITAT.—I found this variety in August 1878 at Ayer Manchor (360 metres above the level of the sea) in the Province of Padang in West Sumatra.

OBSERVATIONS.—Though evidently specifically belonging to *D. melanochaetes*, this is readily distinguished from other varieties by the leaflets having the mid-costa finely and closely hairy-spinulous beneath and the margins spreadingly ciliate.

DAEMONOROPS MELANOCHAETES var. MACROCARPUS Becc. in Rec. Bot. Surv. Ind ii, 219.

DESCRIPTION.—*Leaf-sheaths* and spadices coated with a uniform, furfuraceous, almost black indumentum. *Leaflets* distinctly bristly on 3 nerves above and on the mid-costa beneath. *Outer spathe* rather densely armed with bristly spines, sometimes slightly broader than in type. *Fruit* comparatively large, 2·5 cm. in length (not including the beak) and 1–2 mm. less in breadth; scales very deeply channelled along the centre.

HABITAT.—Collected by Forbes in 1881 at 1,500 metres elevation on Mount Dempo, province of Bencoolen in Sumatra (No. 2326 in Herb. Calcutta).

DAEMONOROPS MELANOCHAETES var. DEPRESSE-GLOBOSUS Teijsm. et Binn. Cat. Hort. Bogor. (1866), 74; Becc. in Rec. Bot. Surv. Ind. ii, 219.

I have not seen specimens of this variety.

HABITAT.—Java or Sumatra?

4. DAEMONOROPS ARUENSIS Becc.

DESCRIPTION.—Scandent. *Sheathed stem* 2·5 cm. in diameter. *Leaf-sheaths* of the upper part of the plant gibbous above, covered with an almost black, removable, crustaceous scurf, and armed with laminar, often seriate, blackish spines. *Leaves* elongate; petiole 15 cm. long, flattish, and with the central part smooth above, its margins prickly, convex beneath, where armed with rather numerous, unequal, straight spines; on the upper surface the rachis is, at first, spinulous at the sides and convex-bifacial upwards, with the salient angle acute, smooth or very remotely spinulous; underneath clawed as in allied species. *Leaflets* very numerous, equidistant, rather approximate, papyraceous, linear-ensiform, from about 5–6 cm. above their base gradually acuminate to a finely subulate tip; the intermediate ones about 30 cm. long and 15 mm. broad; the mid-costa and one slender costula on each side of it furnished on the upper surface with blackish bristles; on the lower the mid-costa alone sparingly, minutely and interruptedly bristly from the middle upwards, margins closely and appressedly spinulous. *Male spadix* . . . . *Female spadix* in fruit erect, 20—25 cm. long without the spathes; outer spathes (seen only in a decayed condition) armed with blackish, filiform spiculae; the pedicellar part of the spadix short and spinulous; involucrophorum pedicelliform, angular, distinctly callous at its axilla; involucre very shallowly cupular; areola of the neuter flower somewhat depressed, with its upper margin strongly swollen. *Fruiting perianth* explanate, with a very slightly callous base. *Fruit* spherical, very shortly conically beaked, 16–18 mm. in diameter, sometimes very slightly depressed; scales in 18 series, rather glossy, not very deeply channelled along the centre, reddish-brown, with a darker, rather broad marginant line, tip slightly prolonged, margins erosely toothed. *Seed* sub-globular, broader than long, in one specimen 14 mm. in one transverse diameter, 10·5 mm. in the other, 12 mm. high, almost equally biconvex and not distinctly ventricose on the raphal side.

HABITAT.—Collected first by *H. N. Moseley* in the Aru Islands during the voyage of the "Challenger" in 1874 (Herb. Kew.), and afterwards by *Warburg* in the same Islands (Herb. Berol.).

OBSERVATIONS.—It differs very little from *D. melanochaetes*, of which at first I had considered it a variety, but the seed is somewhat depressed, almost equally biconvex and not distinctly gibbous on one side; moreover the fruit is slightly smaller and more distinctly beaked, and the leaf-sheaths are armed with more distinctly seriate spines than in *D. melanochaetes*. The seed strongly gibbous on the raphal side is the best character for distinguishing *D. melanochaetes* from several allied forms, a character which seems constant in all its varieties. On this account I have thought it wise not to amalgamate with *D. melanochaetes* a form having an almost equally biconvex seed.

PLATE 5.—Daemonorops aruensis *Becc.*

Portion of the stem with a spadix in fruit and the seed in the lower part of the plate from a specimen collected in the Aru Islands by Moseley (Herb. Kew.); spadix with two detached fruits and portion of leaf from a specimen collected by *Warburg* also in the Aru Islands (Herb. Berol.).

5. DAEMONOROPS PALEMBANICUS Bl. Rumphia, iii, 20 pl. 163B, fig. B; Miq. Fl. Ind. Bat. iii, 102, and Prodr. Fl. Sum. 256, and in Journ. de Bot Néerl., i, 21; Teijsm. and Binn. Cat. Hort. Bog. 74; Becc. in Rec. Bot. Surv. Ind. ii, 219.

Calamus palembanicus Miq. De Palm. Arc. Ind 29; H. Wendl. in Kerch. Palm. 237.

Palmijuncus Palimbanicus Rumph. Herb. Amb. v, 107 ?

DESCRIPTION.—Rather robust. *Leaf-sheaths* covered with an almost black, removable, crustaceous scurf and densely armed with unequal more or less broadly laminar and often seriate black spines. *Leaves* exactly like those of *C. melanochaetes*, but sometimes bristly on 5 nerves above. *Spadices* 40–60 cm. long, including the beak which is about as long as the body or shorter, and spinous only at its base; otherwise the spadices are exactly like those of *C. melanochaetes* except that the outer spathe is densely armed with many, more or less broadly laminar, black spines, which are usually confluent by their bases and more or less partially or interruptedly transversely seriate; some of these spines are 3–4 mm. broad at their bases and 4–5 cm. long, intermingled with smaller ones; those of the basal part of the body are reversed, those of the middle horizontal, the upper ones, and especially those of the base of the beak, ascendent and often longer than the others; the second and third spathe also spinous, but in a far less degree. *Fruit* spherical, 16–18 mm. in diameter; scales slightly channelled along the middle, with a dark marginal line and a very slightly produced obtuse tip. *Seed* irregularly globular, strongly ventricose on the raphal side.

HABITAT.—Sumatra, in the province of Palembang.

OBSERVATIONS.—Probably *D. palembanicus* must be considered as a variety of *D. melanochaetes*, of which it possesses all the characteristics except that the spines clothing the outer spathe are a good deal broader and more distinctly laminar than in the typical forms of *D. melanochaetes* from Java, and also are more or less coalescent by their bases and interruptedly seriate.

Of the type specimen of *D. palembanicus* I have seen a small portion of a leaf and portions of a spadix with male flowers. The leaflets in this specimen are exactly like those of *D. melanochaetes*, are 43 cm. long, 18 mm. broad, with long bristles on 3 nerves above, and sparsely bristly only near the apex beneath; the margins are appressedly bristly-spinulous up to the apex. The spikelets of the male spadix are densely covered on their axial part with a rusty-furfuraceous pulverulent scurf, which, if observed with a good lens, appears adherent to many, small, very slender, subspiny bodies entirely hidden by the scurf, in the young stage of the spadix but visible when this is removed; this structure is apparent, though in a less degree, also in Javanese specimens of *D. melanochaetes*. The nectariform callus at each flexure of the axis of the male spikelets is very distinct.

A very thorough examination of the portions of the type of *D. palembanicus* has allowed me to recognize this in some specimens with male spadices, introduced from Sumatra into the Botanic Garden of Buitenzorg and cultivated there under the name of *D. Lewisianus* Griff., "Rotang Djernang" (*vide* Cat. Hort. Bog. p. 74). From these specimens I have derived my description of the spathes, while that of the fruit is taken from some detached fruits received under the same name of *D. Lewisianus* from the Leiden Herbarium; but it is impossible to be absolutely certain that these fruits are really those of the species to which the male spadices described above belong. I consider also as belonging to *D. palembanicus* another *Daemonorops* from Paja Kombo in Sumatra—cultivated at Buitenzorg under the number 5154—which has very robust male spadices and the outer spathe armed with distinctly laminar spines, some of these being 4 mm. broad at their base. The leaflets often have bristles on 5 nerves above.

Another specimen also brought into the same garden from Sumatra by Teysmann and cultivated as No. 4248 differs slightly from the preceding in the outer spathe having a shorter beak.

PLATE 6.—Daemonorops palembanicus *Bl.*

Male spadix and detached outermost spathe; portion of a leaf-sheath and petiole; intermediate portion of a leaf. From a plant cultivated at Buitenzorg, derived from Sumatra (Herb. Beccari).

DAEMONOROPS PALEMBANICUS var. BANGKANUS Becc.

DESCRIPTION.—*Sheathed stem* about 3 cm. in diameter, armed as in type. *Leaves* 1·5 m. long in the pinniferous part; leaflets 25 cm. long, 15 mm. broad, with short bristles on 3 nerves on the upper surface and rather regularly and closely ciliolate on the mid-costa on the lower. *Outer spathe* armed with laminar, confluent and closely, interruptedly seriate spines, which, compared with those of the type, are short, broad and rigid, 2–4 mm. broad at the base, 1–3 cm. long; this kind of spine covers also a good portion of the beak, where they are more or less seriate or half-whorled, horizontal or somewhat deflexed.

HABITAT.—Introduced from Bangka into the Botanic Garden at Buitenzorg. It is labelled "*Calamus* sp. Bangka. Rakanan."

OBSERVATIONS.—It differs from the type in the short laminar spines which cover the outer spathe.

6. DAEMONOROPS SCHMIDTIANUS Becc. in J. Schm. Fl. Koh Chang, ix, 330.

DESCRIPTION.—Apparently scandent and rather slender. *Leaf-sheaths* . . . . *Leaves* of the upper part of the stem cirriferous; petiole . . . .; rachis with a salient smooth angle and flat side faces in its upper part above, armed underneath upwards, as in the terminal cirrus, with 5-nate or digitate, rather slender claws. *Leaflets* apparently rather numerous, equidistant, the upper ones 2–3 cm. apart, papyraceous, dull and subconcolorous on both surfaces. The largest among those seen by me, are about 30 cm. long and 15 mm. broad, linear-ensiform or very narrowly linear-lanceolate, broadest a little below the middle, and thence gradually narrowing to a rather acute base and acuminate at the apex into a filamentous tip; the mid-costa and one rather distinct nerve on each side of it carrying, on the upper surface, remote, shortish, blackish bristles; on the under surface the mid-costa is minutely bristly from the middle upwards; margins rather closely and spreadingly bristly-ciliate. *Male spadix* erect, subsessile, broadly fusiform, apparently very variable in size, 12–40 cm. in length, including the not very long beak; outer spathe obsoletely two-keeled, covered very densely with weak or flaccid, very narrowly and very thinly laminar, black spines, which are often confluent by their bases and sometimes so slender as to become hair-like; second spathe with fewer and shorter black spines, that are more numerous along the not prominent keels; third spathe with only one longitudinal row of small spines or almost smooth. *Partial inflorescences* densely panicled, cupressiform, rusty-furfuraceous in every part and with many branchlets; the latter carrying 12–13 spikelets in all; the largest of these, the lowest, about 2 cm. long, with 5–6 flowers on each side; spathels bracteiform, just reaching the rim of the cupular involucre with their bluntish or subacute points. *Male flowers* oblong, 4–4·5 mm. long, rather obtuse; the corolla a little more than twice as long as the calyx. *Fruiting perianth* explanate. *Fruit spadix* shortly panicled, erect, rigid; its internodes not tumescent at the junctures; spikelets 2–3 cm. long, their axis at first rusty-furfuraceous, later very slightly scabrid, zig-zag sinuous, about 3 cm. long, with 3–4 flowers on each side; spathels bractiform, broadly triangular, acute; involucrophorum short and thick, not or slightly surpassing the apex of its spathel, broadened at the apex into an asymmetrical subcupular limb, not or very slightly callous at its axilla; involucre cupular, short, truncate, almost completely immersed in the involucrophorum; areola of the neuter flower depressed, slightly tumescent. *Fruit* spherical, 18–20 mm. in diam., tipped by a short beak, neatly marked by 18 longitudinal furrows; scales in 18 longitudinal series, narrowly and rather deeply channelled along the centre, the furrows continuous from one scale to another, of a light, hazel-nut brown colour with lighter scarious polished margins, otherwise dull, the tip slightly produced, obtuse, sometimes darkish. *Seed* globular, very slightly flattened laterally, not ventricose on the raphal side, 13 mm. long and a little less thick, very minutely tubercled. *Embryo* basal, pressed slightly to one side.

HABITAT.—Siam: Koh Chang; collected by *Johs. Schmidt* during the Danish Siam Expedition, 1899—1900 (Nos. 515 and 624^5 in Herb. Mus. Bot. Haun.).

OBSERVATIONS.—Like almost all the other species of this group this has no very salient characters by which it may be easily recognized. Its principal diagnostic characters are the following:—

Upper leaflets of the cirriferous leaves linear–lanceolate, broadest about their middle, with remote, shortish, blackish bristles on 3 nerves above; margins spreadingly and closely ciliate. Spadices erect, subsessile, broadly fusiform and shortly beaked before flowering; outer spathe densely armed with long, very slender, flexible, brittle, often criniform spines; second and third spathe also more or less armed; the beak less than half the entire length of the body. Fruit spadix with internodes not swollen at the junctures; secondary spathes with a very short, not acuminate limb; involucrophorum very short and thick, about as long as its corresponding spathel; involucre almost completely immersed in the involucrophorum; areola of the neuter flower depressed, slightly tumescent. Fruit spherical, 18–20 mm. in diameter, with 18 narrow continuous longitudinal furrows. Seed globular, slightly longer than thick.

The leaflets gradually narrowing to a rather acute base easily distinguish *D. Schmidtianus* from *D. Pierreanus* of Cochin-China and *D. Margaritae* of Hong-Kong, which have narrow leaflets with margins parallel from a little above the base, and the blade suddenly doubled backward at their insertion.

It seems related to *D. Jenkinsianus* and *D. melanochaetes*, but distinguishable from these, as from the other forms of the group, by its comparatively shortly beaked spadix.

PLATE 7.—Daemonorops Schmidtianus *Becc.*

Large male spadix, fruit-spadix and portion of a leaf with 3 leaflets (from No. 515, Danish Siam Expedition). Portion of a cirriferous leaf, a spadix showing its second spathe the first wanting, very small female spadix (from No. 624^b, Danish Siam Expedition.)

7. DAEMONOROPS PIERREANUS Becc. in Rec. Bot. Surv. Ind. ii, 220.

DESCRIPTION.—Scandent? *Stem* . . . *Leaves* . . . *Fruit-spadix* 20–30 cm. long, rigid, panicled thyrsoid, glabrous (when bearing mature fruit) on its axial parts, with 4–5 strict partial inflorescences; the internodes 3–4 cm. long, rigid and thick, somewhat swollen in their lower part; partial inflorescences 8–10 cm. long, carrying about 10 spikelets; third spathe braceiform, amplectent, extended at one side into a broadly triangular acute limb; spikelets 3–6 cm. long, the lower ones, the largest, with 3–7 distichous, rather remote flowers on each side; their axis strongly zig-zag sinuous, glabrous, rather thick and more or less angular; spathels very short, with an annular truncate limb extended at one side into a very short triangular acute point; involucrophorum distinctly pedicelliform and comparatively elongate 3–5 mm. in length), obsoletely angular, sub-obconic, slightly callous at its axilla, with an obliquely and shallowly cupular and unilaterally acute limb, much longer than its own spathel; involucre slightly exceeding the involucrophorum, not very deeply cupular, truncate, entire or very obsoletely 3-denticulate; areola of the neuter flower very distinct, with a strongly swollen, semi-circular upper margin. *Neuter flowers* 5 mm. long, slender; the calyx cylindrical, superficially 3-toothed; the corolla twice as long as the calyx. *Fruiting perianth* explanate. *Fruit* spherical, 16–17 mm. in diameter, tipped by a rather thick mucro; scales in 18 series, finely channelled along the centre, brown, yellowish or of a light cinnamon-brown or hazel-nut colour, rather glossy, with a slightly darker, sometimes obliterate intramarginal line and a light, distinctly erosely-ciliate margin, the apex subacute sometimes darkish. *Seed* globular, slightly broader than long or sub-reniform, and also very slightly laterally compressed; albumen deeply ruminated; embryo basal.

HABITAT.—Lower Cochin-China (*Pierre*). Native name "Le Xom."

OBSERVATIONS.—Under the same No. 4859 M. L. Pierre has given to me two sheets of the *Daemonorops* which was described by me as *D. Pierreanus* (l. c.). On examining again these specimens, it seems to me possible that they may be parts of two different species. The label on one sheet is as follows:—"No. 4859. Truncus erectus! 15—20 m. diam. (*sic*). Folia ultra 2 metr. longa. Fructus edulis. Kmer: Le Xom. Habitat in montibus Kuang Repen, Prov. Ipong. Cambodgia; alt. 600 metr. Coll. L. P.-5-1870." The other sheet has on the label:—"Hab. ad Toikuyen in prov. Bien hoa, austro Cochin-Chinae. Coll. L. P.-1-1873."—Evidently No. 4859 of Pierre's Herbarium is composed of specimens of two different collectings. Therefore to avoid confusion I have based the species only on the fruiting spadix which is on the same sheet with a portion of a non-cirriferous leaf (hereafter described) and which bears the first-mentioned label with the note "truncus erectus." This spadix however seems to me to belong to a scandent species, while the leaf may equally well be that of an erect or of a climbing plant. Therefore it is possible that under No. 4859 of Pierre may be mingled portions of two species of which one is scandent and the other erect; or perhaps these portions belong to one species, but were collected at different stages of development.

A fruiting spadix preserved in the Paris Herbarium and labelled: "No. 929, Cochin Chine—M. le. Dr. Thorel, 1862—1866," apparently belongs to *D. Pierreanus*, or to a closely allied species, and differs from the type specimens in the fruit, which has the scales almost dull-looking and more strongly and narrowly sulcate, and in the spadix, which is more elongate with the basilar internodes very long and the others not swollen at the base. Another specimen from Dr. Thorel bearing also the No. 929, has an unopened spadix, which is almost sessile, elongate-fusiform, 50 cm. long, gradually narrowing into a rather long beak that measures about one-third of the whole length of the spadix; the outer spathe is armed with rather broadly laminar, subulate, scattered spines. The leaf, which is united to the fruit-spadix described above, is not cirriferous and is certainly a radical one; the petiole is elongate, subterete, armed lower down with laminar, acicular, confluent, seriate and comb-like spines, which become solitary and scattered upwards; rachis in the intermediate portion convex and smooth on the lower surface, and with a salient acute and smooth angle and two flat side faces on the upper; leaflets numerous, equidistant, about 3 cm. apart, linear-ensiform, slightly narrowing towards the base, where suddenly backwardly plicate, gradually and subulately acuminate to a bristly tip, sub-concolorous on both surfaces; the upper surface almost glossy with the mid-costa sparsely bristly towards the apex; the secondary nerves slender, one on each side of the mid-costa furnished with long spadiceous bristles about 1 cm. long; underneath the superficial mid-costa bears only a few bristles near its apex; the margins deciduously bristly-ciliate; transverse veinlets very slender, not very approximate.

From what I can judge by the fragmentary specimens at my disposal, *D. Pierreanus* is related more to *D. Jenkinsianus* than to any other species, and appears to be very variable or if it be not, then two or three closely related species are growing in Cochin-China.

PLATE 8. Daemonorops Pierreanus *Becc.* Portion of the leaf and spadix with 4 fruits on the left hand side of the plate (from Pierre's No. 4859 in Herb. Beccari)

unopened spadix, female spadix without the outermost spathe, fruit-spadix and seed, (from Thorel's No. 929 in Herb. Paris).

8. DAEMONOROPS MARGARITAE Hance in Journ. of Bot. 1874, p. 266; Becc. in Rec. Bot. Surv. Ind. ii, 220;
Calamus Margaritae Hance l. c.

DESCRIPTION.—Rather robust, 5 metres and more in length (Hance). *Leaf-sheaths* gibbous above, covered with fugacious rufous scurf and powerfully armed with elongate (2·5 cm. long), flat, deflexed, seriate spines, with many others smaller and needle-like interposed between the larger ones. *Leaves* 1–1·5 m. long in the pinniferous part (6–10—pedalibus—Hance) the author probably including also the terminacirrus); petiole convex and sparingly prickly underneath, above flat and densely covered with short, flat, often confluent, ascendent prickles; rachis, in its first portion, densely prickly above, like the petiole, and having from the middle upwards an upper acute, salient, and prickly angle; underneath armed along the centre of the dorsum with a series of at first solitary, then 2–5 nate and in the cirrus half whorled claws; other small claws are also scattered near the margins on the lower surface of the intermediate portion. *Leaflets* numerous (50–75 pairs—Hance), equidistant, rather closely set, 15–20 mm. apart, green on both surfaces, papyraceous, linear-ensiform, broadest not very far above the base and thence attenuate to a rather acute base and very gradually acuminate to a subulate and bristly tip, 30–45 cm. long, 13–18 mm. broad; on the upper surface the mid-costa acute with one and occasionally two nerves on each side of it which carry some long bristles; on the lower surface the mid-costa alone is sparingly bristly; margins closely and spreadingly ciliate. *Spadices* erect, subsessile, ventricose-fusiform before flowering and shortly beaked, about 25 cm. long; outer spathe cymbiform, gradually and almost equally narrowing towards both ends, the beak being not more than for one-fourth of its entire length acutely two-keeled, armed all over, even on the margin, and externally to the keels, with unequal, flat, often laminate, scattered, spreading or deflexed, 1–2·5 cm. long spines, those of the central part of the body being the broadest and longest; second and third spathe sparingly spinulous; axial parts of the spadix glabrous; secondary spathe and spathels bractiform, broadly ovate, acuminate. Spikelets about 4 cm. long, having a strongly zig-zag sinuous axis and 6–7 flowers on each side; involucrophorum bractiform, embracing the base of the involucre and quite devoid of a pedicellar part; involucre rather deeply cupular, truncate; areola of the neutral flower somewhat depressed, and having a conspicuous, semicircular, tumescent upper margin. *Fruiting perianth* explanate with an apiculate base; the segments of the corolla twice as long as the calyx, lanceolate, rather acute. *Fruit* when young ellipsoid and conically beaked, when quite mature spherical, 20–22 mm. in diameter, tipped by a short stout beak and crowned by the small permanent stigmas; scales in 18–20 longitudinal series, broadly channelled along the centre, almost glossy, dark straw-coloured with light margins and darker intra-marginal line. *Seed* globose, subreniform; albumen deeply ruminate; embryo nearly basal.

HABITAT.—Hongkong, along water courses and streamlets on the hills overlooking the valley of Wongneichung (*Hance*, No. 18407 in St. Petersburg and Paris Herbaria).

OBSERVATIONS.—*D. Margaritae* perhaps resembles *D. Jenkinsianus* more than any other, differing from it chiefly in its short-beaked spadix, and in its outer spathe, which has flat, often laciniate spines, but especially in the involucrophorum, which is quite sessile, reduced to a simple concave bract, wanting the usual more or less elongated pedicellar part. This character distinguishes *D. Margaritae* from all other species allied to *D. melanochaetes* and *D. Jenkinsianus*.

PLATE 9.—Daemonorops Margaritae *Hance.* Lower portion of a leaf, upper surface, spadix with young fruits; (from Hance's No. 18407 in the Paris Herbarium). Female spadix in flower and two full grown fruits; (from Hance's No. 18407 in St. Petersburg Herbarium).

DAEMONOROPS MARGARITAE var. PALAWANIEUS Becc.

DESCRIPTION.—Scandent, of moderate size. *Leaf-sheaths* . . . . *Leaves* of the upper part of the plant elongate, terminating in a long and robust cirrus which is powerfully armed with half to three-quarter whorls of very sharp claws; petiolar part . . . .; rachis spinulous on the salient angle of the upper surface; leaflets numerous, those of the intermediate and upper part of the leaf equidistant, not very closely set, 2·5–3 cm. apart, very narrowly linear-ensiform, acuminate to a filiform tip; on the lower surface the mid-costa and one slender nerve on each side of it bristly, on the upper surface usually smooth; margins very closely and finely ciliate. *Male spadix* . . . . *Female spadix* before flowering elongate-fusiform, about 30 cm. long, erect even when in fruit, borne by a flattened pedicellar part, which, apparently, is 4 cm. long, 6—7 mm. broad and rather densely prickly; outer spathe narrowly cymbiform, shortly beaked, armed with small, short, (5–15 mm. long), unequal, horizontal or deflexed, interruptedly seriate, narrowly laminar spines; the second spathe has a few scattered feeble spines; the third is still less spinous. The panicle in fruit is 12–15 cm. long with few branches; the internodes are slightly swollen in their basal part. *Spikelets* short, with only 2-4 flowers on each sides; involucrophorum sub-sessile or very shortly pedicelliform; involucre cupular, slightly exceeding the involucrophorum, absolutely bidentate on the site of the neuter flower, of which the areola is rather distinctly defined by acute margins, with the basal scar slightly tumescent. *Fruiting perianth* explanate. *Fruit* spherical, abruptly mucronate, about 20 mm. in diameter; scales in 21 longitudinal series with a narrow dark margin, neatly channelled along the centre. *Seed* irregularly globular.

HABITAT.—Philippines. In the island of Palawan, collected by *F. W. Foxworthy*, in May 1906. (Herb. Bureau of Science, Manila, No. 899).

OBSERVATIONS.—I have seen only incomplete specimens of this *Daemonorops*, which is the only one of the group of *Cymbosvatha* hitherto found growing in the Philippine Islands. It apparently differs from typical *D. Margaritae* in the spikelets of the female spadix having fewer flowers, in the sharply defined areola of the neuter flower, and in the outer spathe, being armed with small slender seriate spines.

PLATE 10.—Daemonorops Margaritae *var.* palawanicus *Becc.* The type specimen No. 899 in the Herbarium at Manila.,

9. **Daemonorops grandis** Mart. Hist. Nat. Palm. iii, 327, pl. 175, f. ix and pl. Z xii, f. 11 (diagr.); Miq. Fl. Ind. Bat. iii, 88; Teijsm. et Binn. Cat. Hort. Bot. Bogor. 74; Walp. Ann. iii, 476 and v, 827; Hook. f. Fl. Brit. Ind. vi, 463; Becc. in Rec. Bot. Surv. Ind. ii, 219.

Calamus grandis Griff. in Calc. Journ. Nat. Hist. v, 84, and Palms Brit. India, 91, pl. CCX A (and also B and C?) and pl. CCXVI, f. iii; H. Wendl. in Kerch. Palm. 236; Miq. De Palm. Arc. Ind. 28.

Description.—Robust and scandent. *Sheathed stem* 3–4 cm. in diamter. *Leaf-sheaths* strongly gibbous above, covered with a dark, crustaceous, removable tomentum, rather densely armed with unequal, more or less obliquely and interruptedly seriate, non-confluent, laminar, brown or blackish, broad-based spines, of which some are very short and others 2–3 cm. long and flexible, horizontal or slightly deflexed; those near the mouth ascendent. *Ocrea* very short. *Leaves* (of the upper part of the plant) very large, in one specimen 2·5 m. in the pinniferous part (including the petiole) and prolonged into a long, robust and very strongly clawed cirrus; petiole 30—40 cm. long (2 feet, *Griffith*), flattish or slightly convex above, where armed at the sides with short prickles, its margins acute and also armed with short prickles, of which some point upwards and others more robust are horizontal; underneath the petiole is rounded and sparsely armed along the centre with short spines, which become closer and are gradually transformed into solitary claws upwards; rachis flattish on the upper surface in the first portion, and with a very obtuse carina along the centre and sparsely prickly at the margins: only towards the apex it is trigonous, the carina being transformed into a salient angle with two side-faces; on the lower surface the claws, which are solitary at first, become 3-nate and at the apex form half-whorls of 6–8. *Leaflets* numerous (36 pairs in one specimen), equidistant, alternate or subopposite, rather thickly papyraceous, pale or almost glaucescent beneath, ensiform, somewhat narrowed and suddenly backwardly plicate at the base, gradually acuminate from not very far above the base to a slender, not bristly tip; upper surface with the mid-costa acute and conspicuously raised, the secondary nerves numerous and slender, and all quite naked; underneath the mid-costa is slender and smooth or slightly spinulous from the middle upwards; the other nerves are all naked; margins smooth or sparingly, minutely and appressedly spinulous near the apex; the largest leaflets 40–50 cm. long, and 3 cm. broad; the upper leaflets shorter and a few at the base of the cirrus quite rudimentary. *Male spadix* . . . . *Female spadix* attached eccentrically about 15 cm. below the mouth of its sheath on the ventral side, but apparently emerging from the axil of the leaves; before flowering it is fusiform, 35–60 cm. long (including the beak), erect, with a very short prickly peduncle; outer spathe elongate-cymbiform, gradually narrowing into a long beak, rather acutely dorsally two-keeled, more or less densely armed with laminar, subulate, very sharp, elastic, blackish spines, which are solitary or confluent in small series of 2–5, point upwards and have a broad callous base with a narrow furrow above it; the beak itself is about as long as the body, spinous only at its base; second spathe (not seen by me) with a few spines near its apex, the others usually unarmed and more or less rusty-furfuraceous externally (*Griffith*); flowering axis rigid, densely cupressiform, its internodes short, thick, swollen from the middle down to the base, with few (4–5) principal branches (partial inflorescences) and with a rigid, robust, slightly flexuous axis; the intermediate branches, which are the largest, are 10–12 cm. long, with 4–5 distichous spikelets on each side; the pedicellar part or first internode of the main axis is short and thick, about 1 cm. in length; secondary spathes scale-like, devoid of an elongate sheathing part, but completely amplectent, membranous, exsuccous, extended at one side into a broad triangular, acute or shortly acuminate point; spikelets rigid, erecto-patent, slightly flexuous with a conspicuous axillary callus and transverse rima at their insertion; the lower spikelets, the largest, 5-7 cm. long with 5–6 distichous flowers on each side; the others gradually shorter and with fewer flowers; spathels similar to the secondary spathes but smaller; involucrophorum short and thick or almost depressed, 2–3 mm. long with a very conspicuous axillary callus and transverse rima at its axilla, terminating in a very shallow, entire, asymmetric limb; involucre very shallowly cupular or pateriform, smooth, polished inside, entire or occasionally split by the distension of the fruiting perianth; areola of the neuter flower very conspicuous, almost circular, with a raised and strongly tumescent border. ***Fruiting perianth*** with a flat base, its calyx striately veined externally, split down quite to the base into 3 parts; the corolla not quite twice as long as the calyx, its segments ovate-lanceolate, striate externally. ***Fruit*** spherical, very shortly umbonate, 18–19 mm. in diameter; scales in 15 longitudinal series, the intermediate ones broader than long (8 mm. broad, 6 mm. long) yellowish-brown, with a very narrow darker intramarginal line and a narrow, light, erosely denticulate margin, rather deeply channelled along the centre, and slightly prolonged into an obtuse dark point. ***Seed*** irregularly globular, slightly deficient or with a flattish surface on one side at its upper part; albumen deeply ruminate; embryo basal.

HABITAT.—The Malayan Peninsula: at Malacca (*Griffith*), found again by *Scortechini* at Perak (Herb. Beccari.). *C. grandis* of Kurz (Journ. As. Soc. Beng xliii, 2, 1874, 208) from Rutland Island in the Andamans is my *D. Kurzianus.* Miquel (De Palmis, p. 28) mentions also Sumatra and Borneo as localities of *D. grandis,* but I do not know on what ground. Griffith assigns with doubt to *D. grandis* the Malayan names of "Rotang Sumanbo" or of "Rotang Chry," but the first is usually applied to large species which produce strong, robust canes, fit for stocks of walking canes, and specially to *Calamus Scipionum.*

OBSERVATIONS.—Of *D. grandis* I have seen some fragments of Griffith's type-specimen in the Herbarium at Kew, consisting of a few leaflets, portions of the leaf-sheaths, and a very young spadix; but I received from Father Scortechini a leafy specimen accompanied by a fruit spadix, parts that exactly agree with the corresponding ones of Griffith's type, and from which I have chiefly derived my description. Unhappily that spadix is entirely stripped of its fruits. Further in the Herbarium at Kew are preserved some spadices and loose spathes referred also to *D. grandis,* which apparently correspond to the figure in the centre of pl. CCX, C. of Griffith's work, but I am not sure that these figures really represent the spadices of *D. grandis.* Of the three Griffithian plates illustrating *D. grandis*, I consider as quite certain only plate CCX, A. which exactly corresponds to the specimens examined by me. Griffith's specimens in Kew Herbarium are accompanied by a few loose fruits, which really seem to belong to the leafy type-specimen of *D. grandis*, and these I have made use of in the description above.

D. grandis appears to differ from allied species, chiefly by its comparatively broad, ensiform, thickish and on the lower surface subglaucescent leaflets, which also are on the upper surface quite devoid of spinules or bristles, have the mid-costa bristly spinulous only from the middle upwards on the under surface and have almost smooth margins; the axial parts of the female spadix are shorter and more distinctly swollen at the junctures than in allied species; the involucrophorum is very short and the areola of the neuter flower orbicular, very conspicuous, and tumescent; the spines of the outer spathe are also distinctly callous above their base. *Daemonorops grandis* (not of Mart.) Ridley, Mat. Fl. Malay. Penins. ii, 177 is *D. intermedius* Mart.

PLATE 11.—Daemonorops grandis *Mart* From a specimen collected by, Scortechini (Herb. Beccari.).

10. DAEMONOROPS KURZIANUS Becc. in Hook. f. Fl. Brit. Ind. vi, 463 and in Rec. Bot. Surv. Ind. ii, 219.

D. grandis (not of Mart.) Kurz in Journ. Asiat. Soc. Beng., xliii, 2 (1874), 208.

Calamus grandis (not of Griff.) Kurz For. Fl. Brit. Burma, ii, 523.

DESCRIPTION.—High scandent and robust. *Sheathed stem* as thick as the arm; the canes up to 3 cm. in diameter. *Leaf-sheaths* armed with 15–20 mm. long, flat, black, seriate spines. *Leaves* large, about 2 m. long in the pinniferous part; petiole short and very stout, armed at the base on the back with a few recurved short thorns and several blackish flat spines, and on the upper surface furnished along the margins with short erect thorns which are longer, sharper and rather more irregularly crowded and spreading in its basal portion than elsewhere; the rachis very stout in its first portion (the only part seen by me), 3·5 cm. wide, 1·5 cm. thick, flattish above and spinulous at the sides, rounded beneath, where armed along the centre at first with solitary black-tipped claws, that become as usual 2—3-5-nate higher up and half-whorled on the cirrus. *Leaflets* numerous, equidistant, green on both surfaces, alternate or nearly so, 30—60 cm. long and about 3 cm. broad, elongate-ensiform, broadest not very far from above the base and thence gradually acuminate to the apex; on the upper surface the mid-costa bristly spinulous near the apex and with a slender nerve on each side of it furnished with long black bristles; margins closely and minutely spinulous. *Male spadix* . . . *Female spadix* erect, rigid; outer spathe cymbiform as in *D. melanochaetes* and allied species, covered with a fugacious, brown, scurfy tomentum and armed with numerous clustered or almost pectinate flat spines of the size and shape of those of the sheaths (*Kurz*). *Fruiting spadix* 35 cm. long (in one specimen), with the lower or basal internodes of the main axis 2·5 cm. long, 12—14 mm. thick, tumescent in their lower half, otherwise very similar in every part to that of *D. melanochaetes*; branches or partial inflorescences 15–16 cm. long, in the fruiting stage almost glabrous; lower spikelets of each branch, the largest 8–9 cm. long with a rigid zig-zag sinuous axis and with 6–7 distichous flowers on each side; the internodes of the spikelets (the spaces between two flowers) 5–7 mm. long, cylindraceous or obsoletely angular; spathels with a short annular membranous limb prolonged at one side into a triangular point; involucrophorum pedicelliform, slightly longer than the spathel, slightly obconic and gradually expanded into an oblique and at one side acute bracteiform limb, rather distinctly callous in its axil; involucre shallowly cupular, truncate, entire; areola of the neuter flower distinct, bordered above with a swollen semi-circular ridge. *Fruiting perianth* almost entirely explanate. *Fruit* globular, about 2 cm. in diameter, very shortly beaked; scales deeply channelled along the centre, in 18 longitudinal series, straw-coloured or pale brown with darker margins and a very narrow, scarious, finely erosely toothed edge and a bluntish apex. *Seed* suborbicular, being rather distinctly flattened, 15 mm. in diameter, 11 mm. thick, ruminate; embryo basal.

HABITAT.—Rutland Island in the South Andamans. Kurz says that it is rather common there, and that, besides canes, it yields a small quantity of a good kind of Dragon's blood, which exudes from between the scales.

OBSERVATIONS.—Related to *D. melanochaetes* from which it differs in its much larger size, in the swollen junctures of the basal part of the fruiting spadix, and especially in the orbicular, somewhat flattened seed. Of *D. Kurzianus* I have seen only very incomplete specimens in the Herbarium at Kew. My description of the leaf-sheaths and outer spathe, parts which I have not seen, is derived from that of Kurz.

11. DAEMONOROPS MALACCENSIS Mart. Hist. Nat. Palm. iii, 327; Miq. Fl. Ind. Bat. iii, 88; Walp. Ann. iii, 475 and v, 827; Becc. in Rec. Bot. Surv. Ind. ii. 222.

Calamus acanthopis Griff. Palms Brit. Ind. 102, pl. CCXVI, B; H. Wendl. in Kerch. Palm. 235.

Rotang Kertong Griff. in Calc. Journ. Nat. Hist. v, 94.

DESCRIPTION.—Apparently large and probably scandent. *Leaves* large; the portion of one seen by me, probably belonging to the intermediate part of a leaf from lower part of the stem, has the rachis very acutely trigonous, slightly convex beneath, where armed only along the centre line with small binate or ternate claws, with a very sharp salient not spinous angle and two slightly concave side faces above. *Leaflets* large, very numerous, approximate and very regularly set at an angle of about 45°, papyraceous, rather rigid, ensiform, 50–52 cm. long, 2·5 cm. in width, broadest about 10 cm. above the base and thence very gradually acuminate to a subulate tip, slightly narrowing to the base, where rather suddenly plicate; on the upper surface the mid-costa acute and one slender costula on each side of it furnished from about the middle upwards with short, rather remote, appressed bristles; beneath the mid-costa alone is very minutely and closely bristly from the base to the apex. *Male spadix* very large, broadly fusiform, in one specimen about 60 cm. long including the beak; outer spathe gradually tapering to a moderately long beak, two-keeled, densely armed with numerous, long, very narrowly laminar or subsetiform, black, more or less confluent spreading spines, which cover also a good part of the beak; second spathe armed almost to the apex of its beak with straight, long, erect, slender spines; spikelets of the lower part of the branchlets about 3 cm. long, with about six flowers on each side; spathels bracteiform, concave, rather large, acute, subtending the involucre; the latter cupular, rather deep, shortly bidentate and obsoletely two-keeled posticously. *Male flowers* oblong, 5–6 mm. long. The corolla twice as long as the calyx.

HABITAT.—First discovered by *Griffith's collector* at Malacca. Found again by *H. N. Ridley* in 1900 on Bukit Soga in the State of Johore, No. 11209.

OBSERVATIONS.—Of *D. malaccensis* I had not seen an authentic specimen, and therefore it remained to me a rather doubtful species. Recently, however, I have recognized it in Ridley's specimen above mentioned, which agrees perfectly with the quoted plate of Griffith's work. The spadices represented in that plate want the outermost spathe, but the acutely trigonous leaf-rachis with very approximate, equidistant and relatively broad and large leaflets are very characteristic The rather numerous, erect, long spines, which cover the beak, even of the second spathe, form a good character. It approaches *D. grandis.*

PLATE 12.—Daemonorops malaccensis *Mart.* From Ridley's No. 11205 in Herb. Berol.

12. DAEMONOROPS HYGROPHILUS Mart. Hist. Nat. Palm. iii, 204 (2nd edit.) and 328, pl. 177, f. II and pl. Z VIII, f. VII—XII; Walp. Ann. iii, 476 and v, 827; Miq. Fl. Ind. Bat. iii, 90; Hook. f. Fl. Brit. Ind. vi, 464.

Calamus hygrophilus Griff. Palms Brit. India, 96, pl. CCXIII, C.; H. Wendl. in Kerch. Palm., 236.

DESCRIPTION.—Scandent (ascending, *Scortechini*), robust. *Sheathed stem* 4 cm. in diameter. *Leaf-sheaths* strongly gibbous above, covered (when young) with a thin, brown violaceous indumentum and armed with unequal, flat, laminar, elongate-triangular or comparatively short and broad (5–20 mm. in length and 4-5 mm. broad at the base), deflexed or obliquely inserted, solitary, yet more or less distinctly seriate spines; in the newly exposed sheaths the spines leave on the tomentum an impression of their outline, which disappears later. *Leaves* rather large, 2–2·5 m. long in the pinniferous part; petiole rather short (about 20 cm. long in two leaves), 2 cm. broad, flattish and smooth on upper surface, convex on lower where sparsely armed, as the first portion of the rachis, along the centre line and at the sides with solitary, rather robust, straight prickles; the margins acute, not or very slightly prickly; on the lower surface of the rachis the prickles soon change into claws which at first are solitary, then geminate or ternate and near the apex as on the cirrus, half-whorled; on the upper surface the rachis is smooth throughout, at first convex and with an obtuse, salient angle which becomes very acute with two flat or slightly concave side faces upwards; the cirrus is a good deal shorter than the pinniferous part (in two leaves). *Leaflets* very numerous, very closely set, equidistant, papyraceous, rather rigid, green on both surfaces, narrowly linear, gradually acuminate to a fine, subulate, not bristly or at most slightly spinulous tip, shortly and rather suddenly narrowed towards the base, where distinctly retroplicate; the mid-costa slender but very sharp, furnished as well as one costula on each side of it with long light bristles on the upper surface; underneath the mid-costa only sparsely and minutely ciliolate; secondary nerves rather distinct on both surfaces; the margins apparently smooth, but under a lens very minutely and appressedly spinulous; the intermediate leaflets 30–35 cm. long, 15–17 mm. broad. *Male spadix* before flowering fusiform as usual, but not very ventricose, axillary in appearance only, erect and subsessile, with a smooth unarmed pseudo-pedicellar part, which is adnate to the sheath and decurrent along it; outer spathe very firm, 30–60 cm. long, fusiform-cymbiform, very gradually attenuate into the beak, acutely two-keeled especially at the base, armed with laminar but rather thick elongate-triangular, solitary, scattered, black-tipped spines, which have a rather swollen and light base and are horizontal or slightly reversed, but never point in different directions; the beak is about as long as the body; second spathe unarmed, thinly coriaceous; flowering axis densely cupressiform, 17 cm. long (in one specimen) and with six or seven very approximate partial inflorescences of which the axial parts are densely covered with a pulverulent and rusty indumentum, with many small asperities beneath; spikelets very short and few-flowered, the largest (the lower ones) 2 cm. long, with 4–5 flowers on each side; their axis strongly zig-zag sinuous and distinctly scabrid when freed from the indumentum; spathels bracteiform, amplectent, somewhat extended externally into a circular limb; involucre cupular, truncate, with two small, often bristly teeth, often scabrid at the base when divested of the rusty indumentum by which it is covered. *Male flowers* oblong, obtuse, obsoletely trigonus, or somewhat flattened by mutual pressure, 5–6 mm. long, 2 mm. thick; the calyx campanulate, not deeply 3-toothed, each tooth with a small tuft of rusty hairs at its apex, strongly striately veined; the corolla usually a little more than twice as long as the calyx. *Female spadix* . . . *Fruit.* . .

HABITAT.—The Malayan Peninsula. Sent to Griffith from Malacca by *E. Fernandez* under the name "Rotang Ayer" ("Ayer" is water in Malay). Found again in the district of Perak by *Father Scortechini.*

OBSERVATIONS.—I have seen of this two good specimens with male spadices, collected by Scortechini, who in his notes declares this to be "ascending;" perhaps it is not so high scandent as other species, as the leaf cirri are not very long, though regularly armed with rather approximate half-whorls of black-tipped, rather strong claws. Scortechini describes the male flowers as having the filaments of the stamens dilated at the base, with the anthers pendulous during the anthesis as in grasses, and with a very small rudimentary ovary, 3-lobed at the apex.

It is rather easy to distinguish this species from the allied species by the leaf-sheaths, which are covered with broad, short, scattered spines; by its very numerous, closely-set, equidistant, narrow leaflets, which are bristly on three nerves above and sparsely ciliate on the mid-costa beneath, suddenly narrowing at the base and with an acuminate not bristly tip; by the outer spathe armed with flat, short and broad scattered spines, which have a rather swollen light base; further the axial part of the male spikelets is more distinctly scabrid, when divested of the dense, rusty indumentum, than in other species.

Plate 13.—Daemonorops hygrophilus *Mart.* From a specimen collected by Scortechini at Perak, (Herb. Beccari).

13. Daemonorops stenophyllus Becc. in Rec. Bot. Surv. Ind. ii, 220.

Description.—Scandent. *Leaf-sheaths* 2–5 cm. in diameter; gibbous-plicate above, more or less covered with a tobacco-coloured adherent scurf, armed not very densely with scattered, solitary or subseriate and confluent, very unequal but usually large and broadly laminar, 1–2 cm. long, spreading or deflexed brown-schistaceous spines the mouth obliquely truncate, fringed with a few scattered, erect, long spines. *Leaves* elongate, 1·6 m. long in the pinniferous part, terminating in a slender, 80 cm. long, clawed cirrus (in one specimen); petiole very short or almost obsolete; the rachis in its first portion is flattish and not or very slightly prickly on the upper surface which in the intermediate portion is convex with an obtuse, more or less spinulous angle; only towards the apex the salient angle is acute and smooth; on the under; surface the rachis is convex, smooth or sparingly armed with claws that are solitary, a long way up and then become ternate, and finally 5-nate and half-whorled on the cirrus. *Leaflets* numerous (about 80 pairs in one specimen), equidistant, about 2 cm. apart, papyraceous, green on both surfaces, linear, very narrow, 25–35 cm. long, 9–12 mm. broad, gradually acuminate to a very slender and long filamentous tip, and narrowing also gradually from below the middle downwards to a rather acute base which is distinctly callous below, in the small hollow formed beneath by the folding of the limb; sub-tricostulate, or with the mid-costa on the upper surface acute, bristly spinulous only near the apex and with one rather distinct nerve on each side of it furnished with a few blackish, short bristles; on the lower surface the mid-costa very sparingly bristly or quite naked; margins almost smooth, or very remotely, minutely and appressedly spinulous. *Female spadix* erect, sessile or very nearly so, spinous at its base, ventricose-fusiform before flowering and rather suddenly narrowing into a beak about as long as the body, 30–35 cm. long, including the beak, with 5–6 very approximate partial inflorescences; outer spathe thinly but firmly coriaceous, deeply cymbiform, acutely two-keeled, thinly and more or less partially covered with the same indumentum as the sheaths, rather acutely two-keeled, armed with not many but large, broadly laminar, often deeply lacinate, scattered or slightly confluent, deflexed, 2–4 cm. long spines; second spathe also rather firm, more or less spinulous only near the apex, the others unarmed; axial parts of the spadix sparingly sprinkled with rusty furfuraceous scales; partial infloresences 5–6 cm. long; the largest spikelets, the lowest, 3–4 cm. long with 4–5 flowers on each side; spathels bracteiform, amplectent, extended at one side into a broadly triangular acute point about as long as the involucrophorum; the latter obsoletely angular, short, 2–3 mm. long, sub-obconic, not callous at its axilla, very appressed to the axis, expanded at its apex into an obliquely shallowly subcupular limb, which is produced externally into a triangular acute point, the latter acutely keeled on the back and usually surpassing the margin of the involucre; the other side of the involucrophorum subtends the neuter flower; involucre shallowly cupular, truncate, rather distinctly bidentate on the side of the neuter flower, and almost completely immersed in the involucrophorum; areola of the neuter flower sharply bordered with a basilar, horizontal scar which is very slightly or not at all callous. *Female flowers* broadly ovate, 6 mm. long; the calyx cupular, truncate, very obsoletely 3-denticulate, strongly striately veined; segments of the corolla elongate-triangular, not very acute, twice as long as the calyx. *Neuter flowers* erect from inside the involucrophorum, 4–5 mm. long, narrowly oblong, obsoletely 3-gonous or flattened, often slightly curved. *Fruiting perianth* explanate, with a very short but distinct callous base. *Fruit* spherical, shortly mucronate, 15–16 mm. in diam.; scales in 18 longitudinal series, dirty light-yellowish, not polished except on the margin, which is lighter than the body and finely, erosely toothed, rather deeply and narrowly channelled along the middle, the tip rounded and in the scales of the upper part of the fruit slightly produced and often marked with a dark spot. *Seed* globular.

HABITAT.—At Sungei Bulu in the lowland near Pandang on the west coast of Sumatra *Beccari* P. S. No. 905.

OBSERVATIONS.—Easily distinguishable from the allied species by its leaves almost without a petiole, with numerous, very narrow, not very closely set leaflets; by the outer spathe armed with broad, laciniate, laminar spines; by the fruit with dull scales, and by the not callous areola of the neuter flowers which are erect and subtended by the involucrophorum.

In this species also, I have observed that some of the ovaries were already considerably developed, as if they had already been fertilized, even in spadices which apparently were unopened and with the spathes still completely sheathing the flowers.

PLATE 14.—Daemonorops stenophyllus *Becc.*—From the type specimen of Plant Sum. No. 905 in Herb. Beccari.

14. DAEMONOROPS FISSUS Bl. Rumphia, iii. 17, pl. 144, D—G (excl. f. A—C); Mart. Hist. Nat. Palm. iii, 327; Miq. Fl. Ind. Bat. iii, 89; Walp. Ann. iii, 476, and iv, 827; Teijsm. et Binn. Cat. Hort. Bogor. 74; Becc. in Rec. Bot. Surv. Ind. ii, 219.

Calamus fissus Miq. Anal. Bot. Ind., 6, and De Palm. Arc. Ind. 28; H. Wendl. in Kerch. Palm., 236.

DESCRIPTION.—Scandent, of moderate or rather large size. *Sheathed stem* 3–4 cm. in diameter. *Leaf-sheaths* more or less coated with an almost black or very darkly tobacco-coloured, crustaceous indumentum and densely armed with laminar, unequal (1–5 cm. long.) usually broad-based, rigid, black, scattered, often obliquely inserted spines. *Leaves* large, about 2 m. long in the pinniferous part and terminating in a long and robust cirrus armed with half-whorls of robust black-tipped claws; petiole robust, moderately long, 18–22 mm. broad, flat on the upper surface, rounded on the lower, more or less armed on both surfaces, as on the first portion of the rachis, with very short, unequal, straight, flat, triangular, ascendent prickles and with a few strong divergent spines on the margins; the rachis spinulous on the acute salient angle on the upper surface and armed on the lower with solitary or geminate claws, that become 3-nate and finally 5-nate upwards. *Leaflets* numerous, equidistant, 15–25 mm. apart, linear-ensiform, papyraceous, thin but rather rigid, green on both surfaces, slightly paler beneath, very slightly narrowing towards a not very acute base, broadest 5–8 cm. above the base, and thence very gradually acuminate to a very fine subulate tip; the mid-costa and one, and sometimes two, more or less distinct nerves on each side of it bristly on the upper surface; on the lower the mid-costa alone rather closely and appressedly spinulous; margins rather closely and appressedly spinulous; the largest leaflets, those a little above the base, 40 cm. long, 18–20 mm. broad. *Male spadix* . . . *Female spadix* erect, sessile or nearly so, strongly spinous at its base, ventricose-fusiform before flowering and rather suddenly narrowing into a beak about as long as the body, 50–55 cm. long, including the beak, with 5–6 very approximate, partial inflorescences; outer spathe deeply cymbiform, rather distinctly two-keeled, almost entirely covered with a blackish crustaceous indumentum and armed all over with flat, rigid, rather broad, 1–2 cm. long, blackish, spreading, scattered or somewhat confluent spines; the second spathe spinous only near its apex, the others unarmed; axial parts of the spadix fugaciously sparingly rusty-furfuraceous; partial inflorescences 8–9 cm. long, with 8–10 spikelets in all; the largest of these, the lower ones, 3–4 cm. long, bearing 4–5 flowers on each side and with the internodes between two flowers very short; spathes bracteiform, amplectent, extended at one side into a broadly triangular acute limb; involucrophorum slightly protruding beyond the spathes, short, obconical, angular, slightly callous at its axilla and expanded at its apex into an oblique shallowly subcupular limb which is extended externally into a triangular acute point, the latter about as long as or exceeding the margin of the involucre; involucre exactly cupular, truncate, entire, almost wholly immersed in the involucrophorum; areola of the neuter flower flat, slightly callous only at its base which is immersed in the involucrophorum. *Female flowers* not very broadly ovate, 7 mm. long, acuminate; the calyx cupular, truncate, with three superficial obtuse teeth, not very conspicuously striately veined; the corolla about twice as long as the calyx, its segments lanceolate, narrow in their upper part and acute; *neuter flowers* slender, linear, 6–7 mm. long, 2 mm. thick, often curved, asymmetric, obsoletely trigonous or flattened by pressure; their calyx with three very short teeth, the corolla twice as long as the calyx or even longer. *Fruiting perianth* explanate. *Fruit* globose, slightly ovoid, rather distinctly conically beaked (at least when not quite mature), 13–14 mm. in diameter; scales in 18 longitudinal series, distinctly but not very deeply channelled along the centre, of a rather uniform cinnamon-brown or rusty-ochraceous colour with a rather broad, darker marginal line, tip obtuse.

HABITAT.—On the River Dusson in South Borneo (*Korthals*, fide Miquel), and collected probably in the same region by *Henrici* (fide Blume). In the Kew Herbarium there is a specimen collected by *Low*, on which is given to it the Malay name of "Rotang Sambirangan," but the exact locality is not stated. Teijsmann (*l.c.*) gives the name "Latong bulu."

OBSERVATIONS.—*D. fissus* has been established by Blume on the fruit-spadix of a *Daemonorops* collected by Henrici in Borneo and the leaves of *Calamus Scipionum*, as I have been able to ascertain after inspection of the type-specimen. I have described the same fruits figured by Blume which, however, are not mature enough for a study of the seed. My description of the plant is derived chiefly from some fine specimens with female spadices, sent to me by Dr. Treub, from plants cultivated in the Botanical Gardens at Buitenzorg. Some of the spadices of these specimens have the spathes wholly closed and entirely enveloping the flowering axis; nevertheless they curiously show amongst the flowers where the ovary does not project above the apex of the corolla, many other flowers with the ovary considerably increased in bulk, twice as long as the perianth, ovoid, 6–7 mm. in diameter, conically beaked and with the stigmas at first connivent. As soon, however, as the spathes split, the stigmas, which are linear-subulate and lamellose inside, spread. Apparently only those last ovaries enlarged inside the unopened spathes come to perfection.

D. fissus is easily distinguishable from the allied forms by its distinctly conically-beaked fruit with uniformly cinnamon-brown scales; and by the involucre of the female flower, which is almost entirely immersed in the involucrophorum, flat on the side of the neuter flower, the areola of which is rather sharply bordered, as in many *Calami*, and having the scar of the insertion of the flower quite at its base, embraced by the involucrophorum, and only there slightly callous. The neuter flowers are also more elongate than in the other species of the group of *D. melanochaetes*.

PLATE 15.—Daemonorops fissus *Blume*. From a plant cultivated at Buitenzorg (Herb. Beccari).

DAEMONOROPS FISSUS var. CINNAMOMEUS Becc. in Rec. Bot. Surv. Ind. ii, 219.

DESCRIPTION.—It differs from the type only in having the leaflets shorter, linear-lanceolate, 30 cm. long at most and 15 mm. in width, and in the outer spathe being almost without spines in its basal portion on the back.

HABITAT.—Cultivated in the Botanic Garden at Buitenzorg as introduced from Borneo.

PLATE 16.—Daemonorops fissus *var.* cinnamomeus. From a plant cultivated at Buitenzorg (Herb. Beccari).

15. DAEMONOROPS BINNENDIJKII Becc. sp. n.
D. marginatus (not of Mart.) Teijsm. et Binn. Cat. Hort. Bog. 381 (name only).

DESCRIPTION.—Scandent, of moderate size. *Sheathed stem* 2–3 cm. in diameter, *Leaf-sheaths* densely armed with thick, laminar, rather broad, very unequal, long and short, blackish, usually obliquely inserted, scattered, elongate-triangular spines; near the mouth the spines are very numerous, erect and as much as 4–5 cm. long. *Leaves* about 1·5–1·8m. long in the pinniferous part; petiole 20–30 cm. long, about 1 cm. broad, flattish on the upper surface, rounded on the lower, sprinkled on both surfaces, but especially on the upper, with small tuberculiform prickles and more or less armed on the margins with not very robust, straight spines; the rachis on its upper surface is sparsely spinulous in the lower portion, but higher up the spinules are confined to the acute, salient angle, and disappear towards the apex; on the lower surface it is armed in the usual way with claws, solitary below, 3–5-nate upwards, and half-whorled on the cirrus. *Leaflets* very numerous, very regularly equidistant, inserted at an angle of about 45°, 12–16 mm. apart, thinly papyraceous, green on both surfaces, slightly paler on the lower, linear or linear-sublanceolate, 20–30 cm. long, 10–13 mm. broad, somewhat narrowed towards a not very acute base and gradually acuminate from about the middle, or even below, to a capillary tip; the mid-costa and a rather distinct nerve on each side of it are furnished with rather long, brown bristles on the upper surface; on the lower the mid-costa only is finely and closely ciliate; transverse veinlets slender, but distinct and much interrupted; margins closely and appressedly bristly-spinulous. *Male spadix* . . . . *Female spadix* before flowering rather broadly ventricose-fusiform, rather suddenly narrowing into a beak as long as the body, erect, sessile or almost so, its base densely armed with flat, reversed spines, 25 cm. long in three specimens (but perhaps sometimes larger) including the beak; outer spathe deeply cymbiform, distinctly two-keeled only at the base, thinly coriaceous, armed with numerous, thinly laminar, very finely and long acuminate, elastic, scattered, very unequal, reversed spines; of these some are laciniate, up to 4–5 mm. broad at the base, and 3–3·5 cm. long, and others almost setiform; those at the base of the beak are amongst the longest, but are slender and spreading; the second and following spathes unarmed; axial parts of the spadix glabrous; partial inflorescences 5–6, composed of only 6–7 spikelets; the larger spikelets (the lowest) about 3–5 cm. long with 3–5 flowers on each side, and with the spaces between two flowers acutely angular, 2–4 mm. long; spathels bracteiform, amplectent, extended at one side into a broadly triangular, acute limb; involucrophorum protruding a good deal beyond the spathels, obconical, angular, not distinctly callous at its axilla and expanded at its apex into an oblique shallowly subcupular limb, which at one of its sides subtends the erect neuter flower; involucre raised above the involucrophorum by a rather thick base, its limb shallowly cupular, truncate, entire; areola of the neuter flower flat, with a basal scar and without the usual semicircular swollen border on its upper margin. *Female flowers* broadly ovate, 5 mm. long; the calyx cupular, truncate, with 3 very minute projecting teeth; the corolla about twice as long as the calyx, its segments triangular, acute. *Neuter flowers* slender, acute, 5 mm. long; their calyx with 3 acute teeth; their corolla about twice as long. *Fruiting spadix* very broadly ovate, very dense, 20 cm. long, 15 cm. broad in one specimen; the basal internode of its main axis slightly compressed, 2 cm. long, 1 cm. thick, not at all swollen at the base. *Fruiting perianth* explanate. *Fruit* globose, often very slightly depressed, very suddenly and distinctly conically beaked, 14–16 mm. in diam., 12–14 mm. long (not including beak); scales in 18 series, superficially channelled along the centre, shining, reddish or straw-yellowish brown, with a narrow, light, scarious and erosely toothed margin and a more or less distinct intramarginal line; the tip rather distinctly produced, obtuse, often with a more or less distinct dark spot at its base. *Seed* somewhat broader than long, almost equally bi-convex, 12–13 mm. across, 11 mm. high, 9 mm. thick, elliptical in vertical section.

HABITAT.—Sumatra, in the province of Palembang. Malayan name "Rotang Sobo."

OBSERVATIONS.—I have received some specimens of this, with female spadices in flower, from the Botanic Garden of Buitenzorg, where it is cultivated under the original name of *D. marginatus* T. et B. Under the same name I have received some loose fruits from the Utrecht Herbarium, and these have enabled me to recognise as belonging to this species a fine, entire spadix loaded with fruits, which I have also received from Buitenzorg; the characters of the fruiting spadix in the description above are derived from this material.

D. Binnendijkii, though in general appearance and dimensions similar to *D. trichrous*, offers some characters of its own which render its identification no very difficult task. The involucrophorum is not distinctly callous at its axilla and the involucre of the female flower conspicuously protrudes beyond the involucrophorum, has a thick base, and one of its sides is wholly occupied by the flat and not swollen areola of the neuter flower. Further *D. Binnendijkii* differs from *D. trichrous* and *D. angustifolius* in its outer spathe, which is armed with long, broad, very thin, laminar, often laciniate and excessively finely acuminate spines, and in the beak armed at its base with very long spreading spines.

PLATE 17.—Daemonorops Binnendijkii *Becc.* From a plant cultivated at Buitenzorg (Herb. Beccari.); the two fruits in the lower corner of the left-hand side of the plate are from the Utrecht Herbarium.

16. DAEMONOROPS ANGUSTIFOLIUS Mart. Hist. Nat. Palm. iii, 329, pl. Z XVIII f. iv (diagr.); Walp. Ann. iii, 476, and v. 827; Miq. Fl. Ind. Bat. iii, 89; Hook. f. Fl. Brit. Ind. vi. 464; Becc. in Rec. Bot. Surv. Ind. ii, 219.

D. carcharodon Ridley Mat. Fl. Mal. Pen. ii, 178.

Calamus angustifolius Griff. in Cal. Journ. Nat. Hist. v, 89, and Palms Brit. Ind. 95, pl. CCXIII, A. B.; H. Wendl. in Kerch. Palm, 235.

DESCRIPTION.—Scandent, of moderate size. *Sheathed stem* 2–2·5 cm. in diameter, *Leaf-sheaths* armed with many flat, solitary, scattered or sub-seriate narrowly triangular, rather short, unequal spines, of which the largest are about 1 cm. long; petiole short (10 cm. long in one specimen), flattish on its upper surface, where densely armed, especially near the margins, with very short, straight, flat, triangular, ascendent spines, on the lower surface convex but similarly armed as on the upper with short spines even on the margins; rachis in its lower portion prickly on both surfaces like the petiole, higher up minutely spinulous on the salient angle; the latter at first obtuse and very acute and smooth from the middle upwards, furnished beneath with 3–5-nate claws, which become half-whorled on the terminal cirrus. *Leaflets* numerous, very regularly and closely set, 10–15 mm. apart, more spreading than in allied species, often almost horizontal, linear, comparatively very narrow, thinly papyraceous, green on both surfaces, 20–25 cm. long, 8–10 mm. broad, somewhat narrowed to a not very acute base, gradually acuminate from above the middle to a capillary tip, rather distinctly tricostulate on the upper surface where the mid-costa is bristly spinulous only from the middle upwards, and the side costulae are furnished from not very far above the base with rather long bristles; on the lower surface the mid-costa only is closely spinulous-ciliate. *Male* and *female* *spadices* erect, sessile or nearly so, fusiform before flowering, almost gradually narrowing into a beak which is about as long as the body; outer spathe cymbiform, acutely two-keeled, rather firm, not very densely armed with flat, very thin and elastic, very short or even 1–3 cm. long, scattered or interruptedly seriate spines: those on the upper part of the spathe and at the base of the beak are erect and longer than elsewhere, and at the base shorter and spreading, and never have a distinctly callous base; the second and following spathes unarmed, or the second only with a few spines. *Male spadix* densely panicled, oblong-cupressiform, 17 cm. long, with 6 or 7 very approximate partial inflorescences (in one specimen); their axial parts slightly pulverulent-furfuraceous; spikelets very short and few flowered, the largest (the lower ones), 15–18 mm. long with 4–5 flowers on each side; the axis of the spikelets not very strongly zig-zag sinuous with short and very minutely scabrid internodes; spathes bracteiform, amplectent, extended at one side into a broadly triangular acute point, which reaches the margin of the involucre; involucre cupular, truncate, entire or obsoletely bi-dentate. *Male flowers* oblong, obtuse, 5 mm. long, 2 mm. thick; the calyx campanulate-urceolate, being slightly constricted at the mouth, superficially 3-toothed, strongly striately veined; the corolla twice as long as at the calyx. *Female spadix* 13 cm. long on the whole (when without the spathes) and with 5 partial inflorescences (in one specimen) which are composed of only 6–7 spikelets; the largest spikelets (the lowest) 4 cm. long with 4–5 flowers on each side, and with the spaces between two flowers acutely angular and 2–4 mm. long; spathels bracteiform, amplectent, extended at one side into a broadly triangular acute limb, which is slightly shorter than the involucrophorum; the latter very short (about 2 mm. long), distinctly callous at its axilla, obconical and expanded at its apex into an obliquely subcupular limb, which at one of its sides subtends the neuter flower; involucre cupular, truncate, entire; areola of the neuter flower very distinct and tumescent on its upper margin. *Female flowers* ovate, 5 mm. long; the calyx urceolate-campanulate, very obsoletely 3-denticulate, very strongly striately veined; the corolla almost twice as long as the calyx, its segments narrow, lanceolate, acute. *Fruiting perianth* explanate. *Fruit* rather small, 13–14 mm. in diameter (not quite mature), globose, slightly conically beaked; scales in 15 series, shining, slightly channelled along the centre, of a reddish-brown colour, more yellowish at the base, broadly bordered with a dark chestnut-brown line and slightly produced into an obtuse non-discoloured tip. *Seed* globular, very slightly broader than high.

HABITAT.—The Malayan Peninsula. This species was described by *Griffith* from specimens collected in the Province of Malacca. It has been found again at Singapore, for I consider as belonging to *C. angustifolius* the specimen collected by *Ridley* in that island at Chan Chu Kang and distributed with the No. 4622 (Herb. Kew.), at Selitan (No. 6279 in Herb. Becc.) and at Lawas (No. 5123 in Herb. Becc.). Griffith gives the Malayan name of "R. Ghitta". This is also the name for *D. trichrous*. Ridley gives the name of "Rotang S'pat".

OBSERVATIONS.—I have seen Griffith's type-specimens of this in the Herbarium at Kew, and on this I have chiefly based the description of the leaves; but for the spadices, flowers and fruit I have made use of Ridley's specimens.

Amongst the Malayan species of the group to which it belongs, it is rather easily distinguishable by its leaves with numerous, approximate and very regularly set, comparatively small, linear and narrow leaflets, which are inserted at a very wide angle or almost horizontally; by the very short obconic involucrophorum supporting the neuter flower with one of the sides of its limb, and by the small reddish-brown or alutaceous fruits. It is, however, very closely related to *D. trichrous* Miq., and I feel inclined to consider it as only a variety of this.

In the most typical forms of *D. trichrous* the scales are peculiarly spotted on their points, while the fruits of Ridley's specimen No. 5123, the only ones I have seen of *D. angustifolius*, have the tips uniformly blackish at the margins; but this same colouration occurs also frequently in *D. trichrous.*

It is quite certain that *D. carcarodon* Ridley corresponds to *D. angustifolius* Mart.; while the plant that Ridley has considered as *D. angustifolius* is apparently, at least in part, *D. Sepal* Becc.

PLATE. 18.—Daemonorops angustifolius *Mart.* The male spadix with a portion of a leaf on the right hand side, from Ridley's No. 6279 in Herb. Beccari; the other figures from Ridley's No. 5123 in Herb. Beccari.

17. DAEMONOROPS TRICHROUS Miq. Prodr. Fl. Sum. (1860), 255 and 592 and in Journ. Bot. Néerl. i, 19; Teijsm. et Binn. Cat. Hort. Bot. Bogor. 74; Becc. in Rec. Bot. Surv. Ind. ii, 219.

Calamus trichrous Miq. De Palm. Arc. Ind. 28; Kurz Veget. Bangka in Natuurk. Tijdscr. Ned. Ind. xxvii (1864), 218; H. Wendl. in Kerch. Palm., 238.

DESCRIPTION.—Scandent, of moderate size. *Sheathed stem* 2–3 cm. in diameter. *Leaf-sheaths* of the lower part of the plant and of all non-cirriferous leaves not gibbous above and armed with rather broad, long and short, usually obliquely inserted, scattered, laminar, elongate-triangular spines; the sheaths of the cirriferous leaves gibbous above and apparently armed with smaller spines and with a petiole 20–30 cm. long; the latter (in the non-cirriferous (lower) leaves is channelled above, while in the cirriferous is flattish or slightly convex, sparsely, and not densely prickly on the upper surface, especially near the margins, rounded beneath where armed along the dorsum with solitary and not very strongly curved claws which on the rachis become of the usual kind, 2–3-nate and 5-nate on the cirrus; the margins are armed with variable, straight and sometimes robust spines; on the upper surface the rachis is smooth throughout, obtusely convex at first, bifaced with a very acute, salient angle from about the middle upwards. *Leaflets* numerous, very regularly and closely set (10–15 mm. apart) at a very wide angle or very spreading, thinly papyraceous, green on both surfaces, 20–25 cm. long, 8–10 mm. broad, somewhat narrowed to a not very acute base, gradually acuminate from above the middle to a capillary tip; rather distinctly tri-costulate on the upper surface where the mid-costa is bristly spinulous only from the middle upwards, and the side costulae are furnished, from not very far above the base, with rather long bristles; on the lower surface the mid-costa only is finely and closely bristly-spinulous; the margins very finely and closely spinulous-ciliate. *Female spadix* erect, sessile or nearly so, ventricose-fusiform before flowering, almost gradually narrowing into a beak about as long as the body, with 5–6 very approximate partial inflorescences; outer spathes cymbiform, acutely two-keeled, thinly coriaceous, not very densely armed with thinly and narrowly laminar, short or 1–2 cm. long, scattered, usually deflexed spines, which are not distinctly callous at their base; the second spathe also more or less covered with appressed spines; the others unarmed; partial inflorescences 5–7 cm. long with 8–10 spikelets in all; the largest of these, the lower ones, 3–4 cm. long, with 4–5 flowers on each side and with the spaces between two flowers acutely angular and 2–4 mm. long; spathels bracteiform, amplectent, extended at one side into a broadly triangular, acute limb, which is slightly shorter than the involucrophorum; the latter very short (1–2 mm. long), distinctly callous at its axilla, obconical and expanded at its apex into a obliquely or asymmetrically cymbiform limb which is produced externally into a triangular acute point; involucre exactly cupular, truncate, entire; areola of the neuter flower very distinct, and tumescent on its upper margin. *Female flowers* to be described exactly in the same words as those of *C. angustifolius*. *Neuter flowers* slender, obsoletely 3-gonous, 5 mm. long, narrowing towards a rather acute apex; the corolla about twice, or somewhat less, as long as the calyx. *Fruiting perianth* explanate. *Fruit spadix* 15–20 cm. long, dense, broadly ovate-thyrsoid. *Fruit* globose, very shortly and suddenly conically beaked, 14–15 mm. in diameter; scales in 15 longitudinal series, very superficially channelled along the centre, shining, yellowish or reddish-brown, usually with a whitish scariose erosely-toothed margin and a darker intramarginal line, the tip slightly prolonged and obtuse, marked with a very dark spot; sometimes above the dark spot of the tip may be found a white area, while the dark-coloured part extends at the sides along the margins. *Seed* broader than high, somewhat flattened, 12 mm. long, 11 mm. high, 9 mm. thick.

HABITAT.—Sumatra, in the province of Palembang at Muara dua and at Batu rajah, and also in the Island of Bangka (*Teijsmann*). Malayan name "Rotan Ghetta," in Bangka "Rotang Kikier," and "R. Bongkus" in Sumatra (Teijsmann).

OBSERVATIONS.—Of Teijsmann's type specimen I have seen some loose fruits bearing the No. 3582 of the Herb. Bogor. in the Calcutta and Utrecht Herbaria. I have also received from Dr. Treub some good specimens from plants cultivated at Buitenzorg, undoubtedly belonging to this species. One, labelled "*Calamus* sp. Sumatra, R. Geta" has a small male spadix 13 cm. long, including the beak, which is about as long as the body; the spiklets and the male flowers are exactly like those of *D. angustifolius;* but the second spathe bears a few spines on the two superficial carinæ; the armature of the outer one does not differ from that described for the female spadix.

Another cultivated specimen is labelled "Calamus sp. Bangka. R. Geta" and bears mature fruits. The fruit scales are very variable in the same spadix as to the colour of their margins and tips. The mature fruit apparently does not as in *D. melanochaetes* easily detach itself from the involucre bringing with it the fruiting perianth, so that the latter remains attached to the involucre while the fruit falls without it.

D. trichrous is extremely like *D. angustifolius* of the Malayan Peninsula, and perhaps may be considered as a representative form in Sumatra and Bangka. It differs, however, from *D. angustifolius* in the second spathe being more covered with spines; and in the more globular seed. The fruit of *D. angustifolius* is perhaps also more conically-beaked than that of *D. trichrous*, and the petiole and rachis in this seem less prickly than in the other.

PLATE 19.—Daemonorops trichrous *Miq.* From a plant cultivated at Buitenzorg (Herb. Beccari).

18. DAEMONOROPS INTERMEDIUS Mart. Hist. Nat. Palm. iii, 327, pl. 175, f. viii and pl. Z, xviii, f. viii; Miq. Fl. Ind. Bat. iii, 88; Walp. Ann. iii, 476 and v, 827; Hook. f. Fl. Brit. Ind. vi, 464; Becc. in Rec. Bot. Surv. Ind. ii, 220.

D. grandis (not of Mart.) Ridley, Mat. Fl. Mal. Penins. ii, 177 (ex parte).

Calamus intermedius Griff. in Calc. Journ. Nat. Hist. v, 86, and Palms Brit. Ind. 93, pl. ccxi, A. B.; H. Wendl. in Kerch. Palm., 236.

DESCRIPTION.—Of moderate size; not very high scandent, 5-6 m. in length. *sheathed stem* 2·5–4 cm. in diameter. *Leaf-sheaths* strongly gibbous above, more or less covered with a tobacco-coloured adherent scurf, and armed with comb-like or interruptedly and obliquely seriate, laminar, lanceolate, 2–3 cm. long spines, sometimes with smaller and incomplete rows of smaller spines between the larger ones; the mouth obliquely truncate, not or very sparingly spinous. *Leaves* elongate, 1·6–2 m. long in the pinniferous part; petiole about 30 cm. long in the leaves of the upper part of the plant and a good deal longer (50–60 cm. and more) in the lower ones, plano-convex, smooth above in the central part, but usually strongly armed near and on the margins with rather long, ascendent or divergent, straight spines; the margins also are furnished with a few remote, long, stout, straight, horizontal spines which emerge from the undersurface; rachis smooth throughout on its upper surface, where it is convex and with broad side faces for the insertion of the leaflets in its first portion, with an obtuse salient angle in the intermediate part, that becomes very acute towards the apex; on the lower surface the rachis is armed at first with solitary and upwards with 3–5-nate claws, which become half-whorled on the terminal cirrus. *Leaflets* numerous, equidistant, not very closely set, 3–5 cm. apart, papyraceous, dull on both surfaces, elongate-ensiform, broad as compared with most of the species of the group, 35–50 cm. long, 20–35 mm. broad (the upper ones shorter and the lowest narrower), rather suddenly narrowing to the base and gradually acuminate to a filamentose tip; the mid-costa acute, sparingly bristly towards the apex and with a slender nerve on each side of it (barely distinguishable from many other secondary nerves) more abundantly furnished with rather long bristles; on the lower surface the mid-costa rather closely bristly throughout; the margins minutely and appressedly spinulous, the lower one bordered on the upper surface by a polished, very neat band. *Spadices* erect, sessile or almost so, and frequently spuriously axillary, ventricose-fusiform, gradually narrowing into a long beak and with a slender base, 45–50 cm. long on the whole; outer spathe acutely two-keeled, narrowly cymbiform, its beak about as long as the body or somewhat shorter, armed externally with numerous, narrowly laminar, very acuminate, flexible, sometimes scattered but more frequently confluent, interruptedly seriate or subpectinate or even laciniate, 2–4 cm. long spines: those at the base of the beak occasionally very long. *Male spadix* with 5–6 partial inflorescences; the internode between the insertion of the first and second spathe rather slender, somewhat flattened, about 2 cm. long and forming a distinct peduncular part to the flowering axis; partial inflorescences ovate-thyrsoid with 12–14 very appressed branchlets; each of these carrying on each side 7–8 spikelets; second spathe rather densely, third and sometimes fourth spathe sparingly, spinous; spikelets short and few-flowered, the largest, the lowest of each partial infloresence, 2 cm. long, with three flowers (rarely more) on each side or sometimes on one side only; the axis of the spikelets not very strongly zig-zag sinuous, slightly scabrid and fugaciously and not densely rusty-furfuraceous; spathels bracteiform, amplectent, extended at one side into a broadly triangular acute point that reaches the margin of the involucre; the latter cupular or cupular-subcymbiform, being often slightly elongate transversellly and acute at each side. *Male flowers* oblong obtuse, when mature 7 mm. long, 2·5 mm. thick; the calyx tubular-campanulate with three short broad teeth; the corolla twice as long as the calyx. *Female spadix* 10–18 cm. long (when without the spathes) with 5 partial inflorescences which are composed of 7–8 spikelets; the largest of these, the lowest, 4–5 cm. long with 4–5 flowers on each side; the space between two flowers angular, 3–4 mm. long and during the flowering stage rather densely rusty-furfuraceous, later slightly papillose scabrid; spathels bracteiform, amplectent, extended at one side into a broadly triangular, acute limb which is slightly shorter than the involucrophorum; the latter shortly obconic, distinctly callous at its axilla, expanded at its apex into an obliquely subcupular limb, which at one of its sides subtends the neuter flower; involucre cupular, exactly truncate, entire, slightly protruding beyond the involucrophorum; areola of the neuter flower depressed with its upper margin distinctly tumescent. *Female flowers* ovate, 6 mm. long; the calyx urceolate, obsoletely 3-dentate, strongly striately-veined; the corolla somewhat less than twice as long as the calyx, its segments triangular-lanceolate, acute, connivent during the anthesis, with the stigmas revolute between them. *Fruiting perianth* quite explanate. *Fruit* spherical, very shortly and acutely conically beaked, 17–18 mm. in diameter; scales in 15–17 longitudinal series, straw-yellowish, not very polished, slightly channelled along the centre, with a chestnut-brown marginal or intramarginal line, as sometimes the margin itself is discoloured and scarious, tip not produced, obtuse. *Seed* irregularly globular, somewhat ventricose on the raphal side, 15 mm. in diameter; embryo basal.

HABITAT.—The Malayan Peninsula. Sent to Griffith from Malacca under the Malayan name of "Rotang Chrysa" by its collector *E. Fernandez.* Found again by *Scortechini* in the district of Perak (No. 505 in Herb. Beccari) and by *Sir George King's collector* on Gunong Malacca, between 490—600 m. (No. 7135 in Herb. Calcutt.).

OBSERVATIONS.—Of Griffith's type-specimens I have seen some portions of a leaf in the Herbarium at Kew and a portion of a leaf with one of the outermost spathes in the Calcutta Herbarium. Some of Scortechini's specimens exactly agree with

Griffith's; others are slightly different, as *D. intermedius* appears to be rather a variable plant, especially in the armature of the outer spathe. One of Scortechini's specimens has the sheathed stem only 2 cm. in diameter and is armed with light-coloured spines, while in the type these are usually schistaceous, and the outer spathe is armed with deeply laciniate laminar spines. In other specimens the spines of the outer spathe are scattered and not seriate.

D. intermedius is easily recognised chiefly by its ensiform, comparatively broad, unicostate, remotely inserted leaflets, which also are dull on both surfaces, with a distinct polished band along their lower margins on the upper surface, and by the spadices which have the second, third and sometimes the fourth spathe spinous. My description of the female spadix and of the fruit is derived entirely from specimens collected by Ridley in Singapore, although I consider these as belonging to a local variety, differing very slightly, however, from the type.

Ridley has confused this very distinct species with *D. grandis* Mart., which is a quite different plant with rigid, rather thinly coriaceous leaflets.

D. intermedius according to Ridley is the commonest species in the south of the peninsula in the woods. Native name "Rotang Sumang". It is not valued for any purpose.

PLATE 20.—Daemonorops intermedius *Mart.* From Scortechini's specimens in Herb. Beccari.

DAEMONOROPS INTERMEDIUS var. NUDINERVIS Becc. in Rec. Bot. Surv. Ind. ii, 220.

DESCRIPTION.—It differs from the type in the leaflets usually without bristles on both surfaces and with the margins remotely and inconspicously spinulous only from above the middle upwards; sometimes, however, a few small bristles appear on the side nerves on the upper surface and on the mid-costa on the lower, and the margins are spinulous from a little above the base. In one specimen the leaflets are unusually broad, being as much as 4 cm. in width, and 40 cm. long.

HABITAT.—Singapore: in the Garden jungle (*Ridley* No. 5124, 5122, in Herb. Beccari and Nos. 6172 and 3499 in Herb. Kew.); at Selitar (No. 3506 in Herb. Beccari).

PLATE 21.—Daemonorops intermedius VAR. nudinervis. From Ridley's No. 5122 in Herb. Beccari. Apex of a leaf and male spadices.

PLATE 22.—Daemonorops intermedius VAR. nudinervis. Spadices in flower, with young and quite mature fruit. From Ridley's No. 3506.

19. DAEMONOROPS TREUBIANUS Becc. sp. n.

DESCRIPTION.—Scandent, of moderate size. *Sheathed stem* 2·5 cm. in diameter, more or less covered with a tobacco-coloured scurf, armed with long, broadly laminar, subseriate, non-confluent, spreading or deflexed spines, intermingled with much smaller and erect ones; near the mouth the spines are longer (up to 4 cm. in length) and closely obliquely inserted. *Leaves* very long and comparatively delicate, 1·8 m. long in the pinniferous part and terminating in a not very long, slender and not very regularly clawed cirrus; the petiole has a very clean, almost polished, surface and is 35 cm. long, 12 mm. broad, plano-convex, smooth on the upper surface, with very sharp margins, armed exactly on the edges with small, very sharp, ascendent prickles, and beneath those with a few straight, robust, horizontal, 15–20 mm. long spines; the lower surface is sparsely prickly near the base and armed with a few long straight spines along the centre; the rachis on the upper surface is flat in its first portion and very narrowly channelled on each side, where are inserted the leaflets, higher up is convex and from the middle, in the upper surface, the convexity is transformed into a salient angle, which is very acute only near the apex, and is more or less spinulous throughout; on the lower surface the rachis is rather closely armed immediately from its base with ternate, very sharp claws, which become 5-nate higher up. *Leaflets* numerous, equidistant, not very closely set, 2–2·5 cm. apart, green and dull on both surfaces, thinly papyraceous, linear, very narrow, 25–30 cm. long, 1 cm. wide, broadest a little above the base and thence very gradually acuminate to an extremely fine filiform tip; the mid-costa and one rather distinct nerve on each side of it furnished with rather long bristles on the upper surface; on the lower the mid-costa alone closely bristly spinulous; the margins minutely closely and appressedly spinulous. *Male spadix* erect, exactly fusiform, very gradually narrowing above into a long beak and also gradually tapering into a very slender base which is supported by a pedicellar part, the pedicel being 15–20 mm. long, 6–7 mm. broad, not or slightly prickly, flattened and acutely two-edged; the entire length of the unopened spadix is 40–55 cm., while the flowering panicle is 20–28 cm., with 5–6 partial inflorescences; outer spathe very narrowly cymbiform, acutely two-keeled, sparingly armed with scattered, very narrowly acicular or subfiliform, flexible, 2–4 cm. long spines, those at the base of the beak being the longest; the beak itself about as long as the body; the other spathes are all unarmed; the axial parts of the spadix almost glabrous even before the opening of the spathes; the internode between the first and the second spathes (forming an additional peduncular part to the flowering axis) is slender, 2–3 cm. in length, 4 mm. in width, flattened with acute edges; partial inflorescences 6–7 cm. long, composed of about ten branchlets, each of them carrying 3–4 spikelets on each side; the lowest of these, the largest, 10–12 mm. long with 3–4 flowers on each side, their axis slightly zig-zag sinuous, with very short and almost glabrous spaces between the flowers; spathes bracteiform, amplectent, produced externally into a broadly triangular limb, of which the rather obtuse point does not exceed the involucre; the latter cupular, truncate, obsoletely 2-dentate on the posticous side, with a small but distinct callus at its axilla. *Male flowers* 5 mm. long, oblong, obsoletely 3-gonous, very slightly narrowing towards an obtuse apex; the calyx cupular-campanulate, very superficially 3-toothed; the corolla almost three times as long as the calyx. *Female spadix* . . . *Fruit*. . . .

HABITAT.—I have received this species from the Botanic Garden of Buitenzorg, where it is cultivated with the label "*Daemonorops* Schwenck" without any special reference to its native country. The species is gratefully dedicated to the late Dr. Melchior Treub, who had so largely contributed to my studies, supplying me with splendid specimens of the species cultivated in the garden under his direction.

OBSERVATIONS.—I have derived my description from the upper part of a not yet fertile plant and from some detached male spadices. Probably the leaves of the upper part of a completely adult plant have a shorter petiole than those described above. *D. Treubianus* is distinguished in the group of *D. melanochaetes* chiefly by its leaves with long plano-convex (not prickly above) petioles; by its very narrow not very closely set leaflets; by its erect, distinctly pedicellate, elongate, fusiform spadices, which resemble those of *D. Jenkinsianus* and gradually narrow above into a beak about as long as the body and below to a narrow though rigid base and by the outer spathe sparingly armed with filiform spines that are very long at the base of the beak.

PLATE 23. Daemonorops Treubianus *Becc.* From a specimen in Herb. Beccari, cultivated at Buitenzorg.

20. DAEMONOROPS SEPAL Becc. in Hook f. Fl. Brit. Ind. vi, 469, and in Rec. Bot. Surv. Ind. ii, 220.

DESCRIPTION.—Scandent, 6–9 m. in length, rather slender. *Sheathed stem* 12–20 mm. in diameter. *Leaf-sheaths* slightly gibbous above, covered with a dark tobacco-coloured scurf, densely and irregularly armed with narrowly laminar, elastic, schistaceous, shining, 10–25 mm. long spines, pointing in different directions, scattered or even obliquely inserted in interrupted series. *Leaves* (those of upper and fertile part of the plant) comparatively not very large, 0·75–1 m. long in the pinniferous part and terminating in a not very long cirrus; petiole 10–20 cm. long, 7–9 mm. wide, plano-convex at the base, flattened and biconvex above, smooth or more or less prickly on the upper surface; the margins acute, usually armed with short, straight spines; on the under surface variously armed along the centre with solitary or ternate small claws or even smooth; the rachis flat at the base on the upper surface with slightly excavate side faces, which very soon converge to form a acute, smooth, salient angle with flat side faces; on the lower surface armed along the centre with at first solitary, then ternate, and only nearly the apex 5-nate claws. *Leaflets* comparatively not very numerous (about 35–40 on each side) equidistant, not very closely set, 20–25 mm. apart, thinly papyraceous, rigidulous, green on both surfaces, linear or linear-lanceolate, broadest a little below the middle and thence narrowing down to a rather acute base and upwards very gradually acuminate to a very fine filiform and bristly tip, subtricostulate, or with a rather acute mid-costa and one nerve on each side of it slightly stronger than the other secondary nerves, all three carrying short, blackish bristles on the upper surface; on the undersurface the mid-costa alone closely and minutely bristly throughout; margins minutely and very appressedly spinulous; transverse veinlets distinct, very slender; the leaflets a little above the base are the longest and the narrowest, 25–35 cm. long, 10–11 mm. broad, and almost linear; the upper ones are shorter and broadest in their intermediate part (up to 15 mm. in width) and therefrom linear sub-lanceolate. *Male spadix* erect, subsessile or stalked with a pedicellar part 2 cm. long, fusiform before flowering, entire length 25–30 cm., gradually narrowing into a not very long beak which is about one-half or one-fourth of the length of the body; outer spathe obsoletely 2-keeled, not deeply cymbiform, armed with very narrowly laminar, 1–2 cm. long, scattered or subseriate, acicular spines; inner spathes only four (always?)

all unarmed; the flowering panicle about 15 cm. long with very few (4) partial inflorescences; the axial parts fugaciously rusty-furfuraceous; the internode between the first and second spathes very slender, somewhat flattened, 2 cm. long, 3 mm. broad; partial inflorescences about 6 cm. long with many branchlets; spikelets always very short and very few flowered; the lowest of each branchlet, the largest, 12–13 mm. long with 2–3 flowers on either side and with an additional 1–2 flowered branchlet at its base; their axis zig-zag sinuous, loosely and slightly furfuraceous and not scabrid; spathels bracteiform, amplectent, produced externally into a broadly triangular and comparatively large limb of which the acute or acuminate and hairy tip exceeds the rim of the involucre; the latter cupular, truncate, usually with two rather acute and hairy teeth on its posticous side and with a distinct callus at its axilla. *Male flowers* oblong, obtuse, with almost parallel sides, not very slender in proportion to their length (5 mm. long, 2–5 mm. broad); the calyx superficially 3-toothed; the corolla twice as long as the calyx. *Fruiting spadix* about 30 cm. long, divided into four partial inflorescences (in one specimen) erect or lightly nodding, supported on a pedicel that is 3–5 cm. in length, flattened, 5 mm. broad, with acute and spinulous edges; the main axis rigid, glabrous, not swollen at the nodes; the secondary and tertiary spathes bracteiform, elongate-triangular, very acuminate; partial inflorescences about 8 cm. long. carrying 5–6 spikelets only; the largest of these, the lowest, 4 cm. long, with four flowers on either side, their axis angular, sinous; spathels bracteiform, amplectent, produced on one side into a triangular, acute or acuminate point, which equals in length or even exceeds the involucrophorum; the latter slightly obconical, somewhat stout, obsoletely angular, expanded at its apex into an asymmetric subcupular and unilaterally acute or acuminate limb; involucre cupular, truncate, entire, almost entirely immersed in the involucrophorum; areola of the neuter flower very distinct, slightly depressed and strongly callous. *Fruiting perianth* not quite explanate or with the calyx broadly obconical. *Fruit* ovoid-elliptical or subovoid, very suddenly and stoutly beaked, 24–25 mm. long including the beak, 14–15 mm. broad; scales in 18 longitudinal series, tawny-brown with dark marginal line, not very shining, channelled along the centre and with an exactly triangular, not produced tip. *Seed* globular (not seen quite mature).

HABITAT.—The Malayan Peninsula; on the Gunong Tambang Badak in the district of Perak (*Scortechini* No. 436^b in Herb. Beccari). At Larut also in the district of Perak, between 900—1200 m. (*Sir George King's collector* No. 4133 in Herb. Calcutt.). Malayan name "Rotang Sepal" (Scortechini.).

OBSERVATIONS.—*D. Sepal* is characterized by its slender stem; the not very closely-set leaflets, the flattish, bi-convex, moderately long petiole; the shortly pedicellate, superaxillary spadices, with few (only four) spathes, the outermost armed with very slender and long spines, and prolonged into a beak of not more than one-third of its entire length; and by the obovoid-elliptical fruit, suddenly and stoutly beaked, with tawny scales arranged in 18 longitudinal series and having an exactly triangular point. The fruit in Scortechin's No. 436^b (that described above) is not quite mature, but apparently has attained its full size. The fruit therefore appears much smaller than that of *D. imbellis* and with smaller and more numerous scales than in the latter. *D. Sepal*, *D. Scortechini* and *D. imbellis*, as proposed by me, appear very closely related species which require more complete material to judge of their real specific value.

Ridley (Mat. ii, 174) has reduced my *D. Sepal* to *D. angustifolius* Mart.; I do not know on what grounds.

PLATE 24.—Daemonorops Sepal *Becc.* From Scortechini's specimen No. 43C^{b} in Herb. Beccari.

21. DAEMONOROPS PSEUDO-SEPAL Becc. in Hook. f. Fl. Brit. Ind. vi, 465, and in Rec. Bot. Surv. Ind. ii, 220; Ridley, Mat. Fl. Malay. Penins. ii, 180.

DESCRIPTION.—Scandent, 3–5 m. high and rather slender. *Sheathed stem* 13–17 mm. in diameter. *Leaf-sheaths* rather elongate, fugaciously furfuraceous and ultimately with an almost polished surface, obscurely costulate longitudinally, or with some slightly raised longitudinal ridges, armed not densely with very unequal, sometimes very long (3–5 cm.), flat, very elastic, more or less confluent and rather remotely seriate, schistacous spines; the mouth almost naked. *Leaves* of the upper and fertile part of the plant apparently about 1 m. long in the pinniferous part; petiole elongate, (35–48 cm. in length), 8–10 mm. in width, depressedly plano-convex at the base, flattened sub-biconvex above; the margins acute and with short, straight, scattered (sometimes confluent and divergent) spines except at the base, where they are longer and more approximate; smooth on the upper surface and also on the lower along the centre or only very sparingly clawed there towards its apex; rachis with small and solitary claws along the centre line of the lower surface (the terminal part not seen by me), quite smooth on the upper with the usual salient angle. *Leaflets* comparatively very numerous, equidistant, and rather remotely set (3–5 cm. apart); thinly papyraceous, green on both surfaces, linear-ensiform, 35 cm. in length, 14–16 mm. in width, with the mid-costa acute, not or very slightly bristly only near its apex and with one slender nerve on each side of it carrying very few, short bristles from the middle upwards; on the lower surface the mid-costa alone sparingly, interruptedly and finely bristly-spinulous; transverse veinlets minute, not very distinct; margins minutely and appressedly spinulous only from the middle upwards. *Male spadix* . . . . *Female spadix* inserted near the mouth of its sheath and consequently very far above the axilla of the leaf immediately under it, short, 12–15 cm. long without the spathes), erect even when in fruit, supported by a short (10–15 mm. long) and rather stout (7 m. broad), flattened, prickly, basal part, with very few (3–4), very slightly branched and very few-flowered partial inflorescences, the spikelets being reduced to carrying only 2-4 flowers; the main axis rigid and comparatively thick; the internode between the insertion of the first and second spathe about 2 cm. long, 7 mm. wide, slightly flattened; secondary and tertiary spathes bracteiform, elongate-triangular, acuminate; spathels bracteiform, amplectent, produced at one side into a triangular, acute or acuminate limb; involucrophorum short and thick, sub-obconical, callous at its axilla, expanded at its apex into an asymmetrically subcupular and unilaterally acute limb; involucre cupular, truncate, entire, almost completely immersed in the involucrophorum; areola of the neuter flower distinctly swollen, depressed. *Fruiting perianth* not entirely explanate or with a very short base. *Fruit* spherical, 18 mm. in diameter, mammillate or with a very broad and short blunt beak at its apex; scales not very deeply channelled, arranged in 15 longitudinal series, not very shining, straw-yellow, with a narrow, scarious, finely erosely-toothed margin and a very faint, narrow, intramarginal line; tip obtuse. *Seed* globular, very slightly asymmetrical but not ventricose on the raphal side; embryo exactly basal, very near the hilum.

HABITAT.—The Malayan Peninsula. In very rich soil in the densest jungle at about 100 m. elevation in the district of Perak, gathered by *Sir George King's Collector* (No. 7975 in Herb. Calcutt.) and by *Father Scortechini*, who in his notes says that it is "more like 'Sepal' than any other."

OBSERVATIONS.—It seems a very distinct species, but the material upon which it is founded is very incomplete. Scortechini's specimen consists of two portions of the stem, carrying old, almost rotten fruit-spadices and leaves wanting their apices. The Calcutta specimen bears a spadix with mature fruit, but without spathes.

The principal diagnostic characters of *D. pseudo-sepal* are the elongate leaf-sheaths, more or less distinctly pluricostulate longitudinally; the very long, flattened, subplano-convex petioles; the not very numerous and not very closely-set linear leaflets; the erect, small, shortly stalked, slightly branched and few-flowered spadices, which are inserted near the mouth of the sheath; and the spherical fruit surmounted by a very broad, very short, blunt mucro, and with straw-yellow scales. *D. pseudo-sepal* seems, at first sight, related to *D. Sepal*, but on the whole it is a quite different plant.

PLATE 25.—Daemonorops pseudo-sepal *Becc.* From Scortechini's No. 433^b in Herb. Beccari; the fruit from No. 7975 in the Calcutta Herbarium.

22. DAEMONOROPS IMBELLIS Becc. in Rec. Bot. Surv. Ind. ii, 220; Ridley Mat. Fl. Malay. Pen. ii, 179.

DESCRIPTION—*Stem* . . . *Leaf-sheaths* . . . *Leaves:* the only one seen by me is not cirriferous, probably being one from the lower part of the plant; petiole . .; rachis convex beneath, with an acute, salient angle and flat side faces above, wholly unarmed on both surfaces. *Leaflets* numerous, very regularly set, equidistant, 15–25 mm. apart, thinly papyraceous, rigidulous, green on both surfaces, subshining above slightly paler beneath, linear-ensiform, very long, the largest 35–38 cm. in length and uniformly of 15–17 mm. in width through the intermediate portion, beginning to narrow only from their upper third to a finely subulate, capillary and bristly tip; distinctly 3-costulate above, where the mid-costa is bristly and the side costae have longer bristles than the central, often with an additional secondary nerve on each side interposed, also more or less bristly; the upper surface has thus 5 more or less bristly nerves; on the lower surface the mid-costa alone is finely and closely bristly-spinulous; transverse veinlets rather distinct, numerous and approximate; margins finely and appressedly spinulous. *Male spadix* . . . . *Female spadix* nodding when in fruit, stalked by a distinct pedicellar part 6 cm. long, slender (5 mm.

wide) flattened, prickly at the margins and cn the back; the entire length of the spadix including the pedicellar part is 20 cm.; the main axis is slender, bearing very few partial inflorescences (three in one specimen), each about 8 cm. long with few (3–5) loose, very few flowered spikelets; spathels bracteiform, amplectent, produced at one side into a triangular, acute or acuminate tip; involucrophorum short and thick, sub-obconical, expanded at its apex into an asymmetric subcupular and unilaterally acute limb, callous at its axilla; involucre cupular, truncate, entire, almost entirely immersed in the involucrophorum; areola of the neuter flower depressed, very conspicuously swollen. *Fruiting perianth* with the calyx broadly obconical or subpedicelliform. *Fruit* large, ovoid-elliptical, very suddenly crowned by a short and slender mucro, 3 cm. long, by 2 cm. across; scales not very shining, in 15 longitudical series, uniformly tawny-brown, with a sharp darker marginal line, deeply channelled along the centre and with a triangular non-produced tip. *Seed* globular, slightly oblong or a little longer than broad (18 mm. high, 15 mm. thick), slightly gibbous on one side, not very deeply ruminate; embryo basal, slightly to one side.

Habitat.—The Malayan Peninsula. Collected by *Father Scortechini* in the district of Perak (Herb. Beccari).

Observations.—Scortechini's specimens consist of only a non-cirriferous leaf (probably a radical one) wanting the petiolar part, and of one spadix with mature fruit. The nodding or recurved spadix supported by a long and slender pedicellar part, and the large ellipsoid fruit, would distinguish this at once from *D. Sepal,* if these characters are not individual peculiarities. Indeed, in typical specimens of *D. Sepal* the spadix is sometimes almost sessile, while in other instances it is 2–3 cm. in length; the fruit of *D. Sepal* is smaller and the scales are in 18 longitudinal series (in *D. imbellis* the series are 15).

Plate 26.—Daemonorops imbellis *Becc.* The type-specimen in Herb. Beccari.

23. Daemonorops Scortechinii Becc. n. sp.

D. Sepal var. *sphaerocarpus* Becc. in Rec. Bot. Surv. Ind. ii, 220.

Descriptions.—*Stem* . . . *Leaf-sheaths* . . . *Leaves* terminating in a slender, rather long cirrus; petiole . . . . ; rachis (in the terminal part of one specimen) with a very acute smooth salient angle above, armed underneath with binate and then 3-nate, very fine and sharp claws, which become 5-nate and half-whorled on the cirrus. *Leaflets* numerous, equidistant, 15–18 mm. apart, thinly papyraceous, green on both surfaces, linear or very narrowly linear-lanceolate, the largest—amongst those seen by me—22 cm. in length, 11 mm. in width, being broadest about the middle and thence slightly narrowing towards the base and gradually acuminate to a subulate apex; the mid-costa and one slender nerve on each side of it carrying delicate bristles; beneath the mid-costa only sparingly bristly spinulous; transverse veinlets sharp; margins finely and appressedly spinulous. *Male spadix* . . . *Female spadix* fusiform and shortly beaked, before flowering its entire length is 20 cm. and it supported on a slender, prickly, 15–20 mm. long pedicel; outer spathe cymbiform, rather acutely two-keeled, almost equally narrowing towards both ends, the beak being only 4 cm. in length (in one specimen), armed with narrowly laminar, rather short (5–10 mm.), feeble, deflexed, often seriate spines; inner spathes (only four) unarmed. *Fruiting spadix* nodding; its main axis slender, supporting very few partial inflorescences (four in one specimen) that are 6–7 cm. long with few (5–6) short, loose, few-flowered spikelets; spathels bracteiform, amplectent, produced at one side into a triangular acute or acuminate point; involucrophorum sub-obconic, thick and short, callous at its axilla, expanded at its apex into an asymmetrically subcupular and unilaterally acute limb; involucre cupular, truncate, entire, almost entirely immersed in the involucrophorum; areola of the neuter flower depressed, with its upper margin conspicuously swollen. *Fruiting perianth* not quite explanate, the calyx forming a very short but distinct pedicel. *Fruit* globular, 2 cm. in diameter, slightly narrowing towards the base or subturbinate, with a round or slightly depressed vertex, and surmounted by a very short conic black beak; scales in 15–16 longitudinal series, uniformly tawny-brown, with a sharp darker marginal line, very deeply channelled along the centre, tip slightly produced, obtuse. *Seed* globular, 14–16 mm. in diameter, sometimes slightly depressed, not very strongly ruminate, not ventricose on the raphal side; embryo basal, very near the hilum.

HABITAT.—The Malayan Peninsula. Collected by *Father Scortechini* in the district of Perak (Herb. Beccari).

OBSERVATIONS.—Of this I have seen two spadices, one in flower, the other in fruit, and the apex of a cirriferous leaf. It is certainly related to *D. Sepal*, but it differs in the more slender and nodding spadix, in the outer spathe armed with short spines, in the round fruit with fewer larger and deeply channelled scales, and in the globular, slightly depressed seed.

PLATE 27.—Daemonorops Scortechinii *Becc.* The type specimen in Herb. Beccari.

24. DAEMONOROPS SINGALANUS Becc. in Rec. Bot. Surv. Ind. ii, 219.

DESCRIPTION.—Scandent and of moderate size. *Sheathed stem* 2–5 cm. in diameter. *Leaf-sheaths* slightly gibbous above, covered with a blackish crustaceous scurf, densely armed, except on a bare area in their upper part on each side at the base of the petiole, with approximate, irregular, deflexed rows of unequal, broadly laminar, or even acicular, short, or as much as 3 cm. long, blackish or schistaceous, confluent spines; the mouth obliquely truncate and armed with long erect spines on its anticous aspect. *Leaves* of the upper part of the plant 1–2 m. long in the pinniferous part (in one specimen), terminating in a rather slender cirrus which is 60 cm. long; petiole short (10 cm. long), plano-convex at the base, flattened and sub-biconvex higher up, not prickly on its upper surface, its margins not very acute and armed with straight solitary spines; the rachis armed beneath with at first solitary, then 3–5 nate, and on the cirrus half-whorled, very sharp claws; the upper surface is smooth throughout with the exception of a few straggling spinules, and is at first convex with broad sides for the insertion of the leaflets, but from the middle upwards the convexity is transformed into an acute, salient angle, with flat side faces. *Leaflets* numerous (about 60 on each side), equidistant, 15—20 mm. apart, green and rather dull, slightly paler beneath, thinly papyraceous but rather firm in texture, linear-lanceolate, the largest those a little above the base, 26–27 cm. long, 12–16 mm. wide, broadest about the middle and thence gradually narrowing to an acute base and to a subulate and bristly tip, rather distinctly 3-costulate on the upper surface, with the mid-costa very sharp and a distinct secondary nerve on each side of it, all three but especially the side ones carrying very slender rather long bristles on the lower surface; the mid-costa above very finely and closely bristly-spinulous; the margins closely finely and spreadingly ciliate. *Spadices* distinctly supra-axillary, nodding, supported by a very slender, flattened, prickly pedicellar part. *Male spadix* elongate-fusiform before flowering, very gradually narrowing into a slender beak one-third the length of the body, the whole length of the spadix being 35 cm. without the peduncular part; the latter 4 cm. long, 4 mm. wide; outer spathe cymbiform-fusiform, very gradually narrowing to the base where, more than upwards, rather acutely two-keeled, sparingly armed between the keels with scattered, very slender, long, acicular spines, naked on the very broad margins and almost smooth on the upper part and on the entire beak; the other spathes quite unarmed; the axial parts of the spadix almost glabrous, even when still enveloped by the spathes; the internode between the first and second spathe slender, about 2 cm. long, 4 mm. broad, slightly flattened, with rather acute edges; partial inflorescences 4–5, rather short, ovate, 5–6 cm. long, composed of about 12 branchlets, each of these carrying 4–5 spikelets on each side; the lowest spikelets are the largest, 12–15 mm. long with 4–5 flowers on each side, their axis slightly zig-zag sinuous with very short and almost glabrous spaces between the flowers; spathels bracteiform, amplectent, produced externally into a broad limb subtending the involucre: the latter cupular, truncate, entire with two very minute teeth on the posticous side. *Male flowers* oblong or ovate-oblong, obsoletely trigonous, about 4 mm. in length, slightly narrowing towards an obtuse apex; the calyx campanulate, superficially 3-dentate; the corolla about twice as long as the calyx. *Fruiting spadix* nodding or recurved, 40 cm. long including 15 cm. of the peduncular part (in 2 specimens) which consists of a true prickly pedicel 8 cm. long, 6 mm. thick, and of the elongate and equally slender and flattened internodes, interposed between the insertion of the two outermost spathes; partial inflorescences five, usually accompanied by their persistent papyraceous spathes, 7–9 cm. long, erect, strict, shortly stalked, not callous at their insertion and composed of 8–10 spikelets; the main axis sinuous and slender; the largest spikelets, the lowest of each partial inflorescences, 4 cm. long, with 4–5 flowers on each side; spathels bracteiform, extended at one side into a very broadly triangular acute limb; involucrophorum short and thick, slightly exceeding its spathel, not or indistinctly callous at its axilla, expanded at its apex into an obliquely subcupular limb, which with one of its sides subtends the neuter flower and with the point of the other exceeds the margin of the involucre; the latter almost entirely immersed in the involucrophorum, cupular, truncate, slightly bidentate on the side of the neuter flower; areola of the neuter flower flat, bordered on both sides by an acute raised ridge, with a basal circular scar, not or very slightly swollen on its upper side. *Female flowers* ovate, 6 mm. long; the calyx cupular, strongly striately veined, superficially 3-denticulate; the corolla about twice as long as the calyx, its segments rather broadly triangular-lanceolate, acute. *Neuter flowers* obscurely trigonous, ovate-pyramidate, rather acute, 5 mm. long; the calyx more or less distinctly 3-dentate, the corolla not twice as long as the calyx. *Fruiting perianth* explanate. *Fruit* globular, 2 cm. in diameter, sometimes very slightly turbinate or with its vertex slightly depressed and minutely beaked, and very slightly narrowing towards the base; scales in 15 longitudinal series, shining, deeply channelled along the centre, with a rather elongate triangular point, straw-yellow with a dark marginal line. *Seed* subreniform (broader than high) and distinctly depressed, 14–15 mm. long, 11 mm. high, 9 mm. thick; embryo basal.

HABITAT.—I discovered this species at about 1800 m. altitude on Mount Singalang in the Province of Padang in West Sumatra, in June 1878 (P. Sum. No. 291).

OBSERVATIONS.—It is easily recognisable amongst the species of the group by its nodding long stalked spadices, persistent spathes, and many other peculiarities. It seems to be more closely related to the species of the group *D. melanochaetes* than to *D. Sepal* and its allied species.

PLATE 28.—Daemonorops singalanus *Becc.* Portion of the stem with male spadices; spadix with quite mature fruits. From P. Sum. No. 291 in Herb. Beccari.

25. DAEMONOROPS MONTICOLUS Mart. Hist. Nat. Palm. iii, 328, pl. 175, f. V; Miq. Fl. Ind. Bat. iii, 90; Walp. Ann. v, 827 and iii, 477; Hook. f. Fl. Brit. Ind. vi, 465; Becc. in Rec. Bot. Surv. Ind. ii, 221.
Calamus monticolus Griff. in Calc. Journ. Nat. Hist. v, 90, and Palms Brit. India, 97, pl. CCXIV. A. C.; H. Wendl. in Kerch. Palm. 237.

DESCRIPTION.—Erect, 2·5 m. high. *Sheathed stem* about 2·5 cm. in diameter. *Leaf-sheaths* armed with long, deflexed, flat, subulate, black thorns, disposed in lines but individually distinct; surface dark-brown from adherent scurf; the mouth obliquely truncate, almost spineless. *Upper leaves* alone cirriferous; petiole about 25 cm. long, armed with a dorsal row of stout claws and along the margins with long, generally deflexed spines; the rachis convex and armed with palmate claws on the lower surface, unarmed and with a salient angle on the upper; the cirrus itself 45 cm. long; leaflets alternate or often subopposite, rather numerous and approximate, equidistant, linear, 25–27 cm. long, 10–15 mm. broad, subulately acuminate to a bristly tip, the central and two lateral veins bristly on the upper surface, smooth on the lower except that the mid-costa bears towards the apex numerous small bristles; margins bristly. *Spadices* slightly supra-axillary, approximate towards the apex of the plant but not very closely, the leaf sheaths not being excessively short. *Male spadix* . . . . *Female spadix* erect, supported on a short peduncular part, fusiform before flowering, 35–40 cm. long on the whole; the outer spathe covered when young with black scurf, acutely two-keeled, armed between and along the keels with scattered, weak, long, subulate, deflexed, flat, black spines; the beak about as long as the body, armed, except towards the apex, with not many, very long, deflexed subulate, sub-bristly spines; partial inflorescences 4–5; the internodes not distinctly tumescent at the junctures, rather slender, the lowest 2–3 cm. long; secondary spathes amplectent, short, acute or subulate at one side; the branches bearing few spikelets, the latter with a sinuous axis, 3–5 cm. long, and with

5–7 distichous flowers in all; the largest spikelets, the intermediate ones, occasionally with 1–2 secondary few-flowered spikelets on each side; involucrophorum sub-obconical, short (1–2 mm.) and thick, with an asymmetric subspathaceous and unilaterally acute limb, its apex often exceeding the involucre, not or very slightly callous at its axilla; involucre very shallowly cupular, truncate, entire, indistinctly veined externally; areola of the neuter flower depressed, distinctly swollen on its upper side. ***Fruiting perianth*** explanate. ***Fruit*** apparently rather small, globose and conically beaked (when not quite mature); scales in 18 longitudinal series, channelled along the middle, rather dull, cinnamon-brown, their apex very obtuse and not spotted; the margins finely erosely toothed, and with a narrow and uniform chestnut-brown intramarginal line.

HABITAT.—The Malayan Peninsula. Somewhat gregarious in thick forests on Gunong Miring, an off-set of Mount Ophir, at an altitude of 500 or 600 metres. (*Griffith*).

OBSERVATIONS.—Imperfectly known. My description is chiefly derived from Griffith, completed with the notes taken on the very fragmentary, authentic specimens in the Herbaria of Kew and Calcutta. In both Herbaria the spadices want the outermost spathe, and this makes precise comparison with allied species difficult.

Its chief characters are:—***Stem*** erect; only upper leaves cirriferous; leaf-sheaths armed with scattered or subseriate, long, laminar, non-confluent spines; leaflets rather numerous, equidistant, linear, narrow, rather numerous and approximate, subulate and bristly at the apex; spadices slightly supra-axillary, approximate, but not crowded at the apex of the plant, supported on a short peduncle, the sheaths not being excessively short; outer spathes cymbiform-fusiform, long-beaked, armed between and along the prominent keels with scattered, weak, long spines; the beak about as long as the body and sparsely armed on its basal part with very long, deflexed, subulate, sub-bristly spines; partial inflorescences short, and with but few short, few-flowered spikelets; involucrophorum thick and short; areola of the neuter flower distinctly callous, depressed. ***Fruit*** small, globular, conically beaked.

It would appear to me that the specimen given by Ridley to the Calcutta Herbarium under No. 7100, collected by Ridley himself in December 1898 on Bukit Juru, Prov. Wellesley is to be referred to *D. monticolus.* This same number Ridley (Mat. l. c.) considers to belong to *D. Lewisianus* Mart.

DAEMONOROPS MONTICOLUS var. PINANGIANUS Becc.

D. monticolus var. β. Becc. in Rec. Bot. Surv. Ind. ii, 221.

D. monticolus Griff., Ridley, Mat. Fl. Malay. Pen. ii, 175.

Calamus monticolus Griff. Palms Br. Ind. 97, only as to the plant of Pinang and pl. CCXIV, B).

DESCRIPTION.—Erect. ***Sheathed stem*** 1–2 cm. in diameter. ***Leaf-sheaths*** more or less (sometimes indistinctly) costulate longitudinally, covered with a removable, dark-brown scurf; those of the upper part of the plant slightly gibbous above and armed not very densely with long, deflexed, narrowly laminar, subulate, solitary or subseriate, but individually distinct spines. *Ocrea* very short, obliquely truncate. ***Leaves*** of the upper and fertile part of the plant rather small, with not many leaflets and terminating in a slender, not very long cirrus; petiole rather elongate, 10–25 cm, long. slightly arched, plano-convex, more or less armed on the margins and along the centre of the dorsum at the base with shortish, weak, straight or slightly hooked spines, which higher up and on the rachis are transformed into solitary claws, becoming ternate in the terminal part and finally 5-nate on the cirrus; the pinniferous part 30–50 cm. long; leaflets not many (15–20 on each side), slightly inequidistant, 1·5–3m. apart, narrowly linear-lanceolate, broadest at or a little below the middle and thence gradually narrowing below to a rather acute base and upwards to an acuminate and bristly tip, thinly papyraceous, with the mid-costa acute and one slender nerve on each side of it bristly above; beneath, the mid-costa alone more or less bristly throughout; transverse veinlets rather sharp; margins closely bristly-spinulous especially towards the apex; the largest leaflets, those a little above the base, 15—18 cm. long, 6–12 mm. broad. *Spadices* approximate towards the apex of the plant, but not very closely, the sheaths not being excessively short. *Male* spadix before flowering fusiform, gradually narrowing into a beak about as long as or shorter than the body, erect, more or less shortly supported on a rather slender pedicel which is flattened, smooth or slightly spinulous on the margins, decurrent along the sheath and emerging about the middle of its sheath; outermost spathe concave-cymbiform, 40–50 cm. long including the beak in large specimens, 15–20 cm. in very small ones, not very acutely two-keeled, armed, usually rather densely, with elongate, very narrowly laminar, black, scattered or subseriate spines, which point in different directions but chiefly downwards, those at the base of the beak being the longest (up to 4–5 cm.) often confluent and subseriate; partial inflorescences 5–6 as usual, the branchlets 4–5 cm. long and with about ten spikelets; of these the lowest 12–14 mm. long with 3–4 flowers on each side; the upper ones slightly shorter and with fewer flowers; their axis sinuous, slightly scabrid, furfuraceous; spathels bracteiform, triangular, acute at one side; involucre cupular, sub-cymbiform with an acute point on each side, callous at its axilla. *Male flowers* linear, slender, 6–7 mm. long, 2 mm. thick, rather acute; the calyx tubular, superficially 3-dentate; the corolla twice as long as the calyx. *Female spadix* . . . .

HABITAT.—The Malayan Peninsula: Pulo Penang at Balik Pulau (*Ridley* Nos. 7900, 7902, 7897 in Herb. Calcutt.). On the Penang Hill, about halfway up (*Griffith*), and on the same hill found again by *Ridley* in 1896 (No. 7896 in Herb. Calcutt.—a very delicate form).

According to Ridley (Mat. l. c.) his No. 7900 belongs to *D. angustifolius;* No. 7897 to *D. calicarpus* and No. 7896 really to *D. monticolus.*

OBSERVATIONS.—Griffith has described under the name of *Calamus monticolus* a plant from Mount Ophir and another from Pulo Penang; but the two do not seem to me exactly alike. Further, three plates in Griffith's work represent *D. monticolus,* but these also are evidently referable to two different plants, though apparently forms of the same species. Plate XXIV-A represents the apex of a non-cirriferous leaf but it is difficult to decide to which of the two it belongs. Plate XXIV-B is so exactly like Ridley's Penang specimens Nos. 7900 and 7896 in the Calcutta Herbarium, that it appears evident that it represents the plant from Penang of which Griffith speaks at pp. 97–98. Plate XXIV-C represents two spadices in fruit, with the outer spathe armed with very few spines occurring chiefly on the two acute carinae, while on the outer spathe of the spadix in plate XXIV-B these spines are very numerous and are scattered irregularly over its entire surface. Now as Griffiths in the diagnosis of *C. monticolus* describes the "spatha extima secus carinas duas spinis gracilibus deflexis armata" and as this character is more clearly represented in plate XXIV-C than in the other, I feel almost certain that this last plate represents the spadices of the type *D. monticolus* from Mount Ophir; unfortunately the type-specimens of this in Kew and Calcutta Herbaria want the outermost spathe.

The var. *pinangianus* of *D. monticolus* differs from the type in the outer spathe being not very acutely two-keeled, and more densely covered throughout with spines; in the fewer, broader, less numerous, and less regularly set leaflets, and apparently in the smaller and rounder fruit. This, however, I have seen only in Griffith's plates.

PLATE 29.—Daemonorops monticolus *var.* pinangianus *Becc.* Portion of the stem with a very small spadix and an entire leaf in the upper part of the plate, from Ridley's No. 7896 in the Calcutta Herbarium; the other two spadices (♂) from Ridley's No. 7897 in the same Herbarium.

26. DAEMONOROPS LEWISIANUS Mart. Hist. Nat. Palm. iii, 327, pl. 175, IV f. 1—7 and pl. Z xviii; Miq. Fl. Ind. Bat. iii, 89; Walp. Ann. iii, 476, and v, 827; Hook. f. Fl. Brit. Ind. vi, 465; Becc. in Rec. Bot. Surv. Ind. ii, 221; Ridley, Mat. Fl. Mal. Penins. ii, 176 (partim ?)

Calamus Lewisianus Griff. in Calc. Journ. Nat. Hist. v, 87, and Palms Brit. India, 94, pl. CCXII, A., B.; H. Wendl. in Kerch. Palm. 236 (excl-syn.); Miq. De Palmis Arc. Ind. 28.

DESCRIPTION.—Erect or sub-scandent (?). *Sheathed stem* about 3 cm. in diameter *Leaf-sheaths* (of the upper part of the plant) rusty-furfuraceous, very slightly gibbous or transversely plicate under the petiole, armed with flat, rather broadly laminar, elastic subulate, 2–4 cm. long, brown spines, which are solitary, scattered and not very crowded or even confluent by their bases and more or less obliquely and not very closely seriate, with shorter spines between the series of the larger ones; the mouth almost naked. *Ocrea* very short, truncate. *Radical leaves* apparently long-petioled and considerably larger than the upper ones; leaflets numerous, rather closely set, equidistant, broadly linear, long-acuminate, the largest seen by me 15–20 mm. broad, subconcolorous on both surfaces, with the mid-costa acute, and one very slender nerve on each side of it sparsely bristly above; underneath the mid-costa alone finely and closely bristly from the base to the apex, but apparently the bristles more or less deciduous with age; margins rather closely and spreadingly bristly-ciliate, especially towards the apex. *Upper leaves* (not seen by me) apparently with the petiole broadened at the base, and there armed with shortish, deflexed spines (*Griffith*). *Spadices* approximate to the apex of the stem, before flowering fusiform-elliptic and moderately or shortly beaked, axillary in appearance, erect, supported on a short pedicel (1 cm. long) which is more or less prickly on the dorsum and at the margins; outermost spathe cymbiform, furfuraceous, two-keeled, narrowed into a beak, which is half the length of the body and is armed with narrowly laminar, subulate, elastic, rather long, blackish, not very crowded, solitary spines, often so slender as to become bristly; second spathe slightly spinous along the two keels; the others glabrous and of a cinnamon colour. *Male spadix* (when not enveloped by the spathes) densely panicled, thyrsoid; rusty-furfuraceous on the axial parts, with about five branches (partial inflorescences), each 5–6 cm. long, decompoundly divided into branchlets which bear 3–4 very small spikelets on each side; secondary spathes amplectent; spikelets very short, rarely more than 1 cm. in length with very few flowers (3-6 in all); spathels amplectent, bracteiform, very slightly prolonged at one side, obtuse or slightly apiculate; involucre cupular, exactly truncate, the third part of the length of the calyx, more or less distinctly 2-toothed on the side next to the axis, teeth ciliate. *Male flowers* comparatively large, 6–6·5 mm. long, 2·5 mm. broad, oblong, obtuse; the calyx tubular-campanulate, very superficially 3-toothed, its margin ciliate-furfuraceous, especially on the apex of the teeth; the corolla twice as long as the calyx, or longer, divided two-thirds down into three oblong-lanceolate, rather obtuse segments; stamens with filaments connate together for about two-thirds of their length, rather thick and subulate in the free part; rudimentary ovary very small. *Female spadix* (when not enveloped by the spathes) short, densely panicled, with 4–5 small partial inflorescences; the joints of the main axis furfuraceous, the lower ones short (10–12 mm. long) and tumescent from midway down, the upper slender and more elongate; partial inflorescences very short, with only 2–3 alternate spikelets on each side; secondary spathes bracteiform, amplectent, acuminate, very finely veined; spikelets very short with a sinuous axis and 5–6 distichous flowers in all; spathels bracteiform, amplectent, acuminate, finely striate; involucrophorum rather thick, about 3 mm. long with a distinct axillary callus and a deep transverse fovea, expanded at the apex into a sub-spathaceous and unilaterally acute limb; involucre cupular, rather deep, about the third part of the length of the calyx, truncate, entire or very obsoletely 2-dentate, finely striately-veined externally; areola of the neuter flower orbicular, with a semicircular swelling on its upper margin. *Female flowers* ovate, 6 mm. long; the calyx urceolate, very superficially 3-toothed, rather strongly striately-veined externally; the corolla longer by one-third than the calyx, ventricose in the part included in the calyx, divided down almost to the base into three segments which are suddenly narrowed from the middle upwards into a lanceolate point; staminal urceolum crowned by six short apiculate teeth; anthers small, sagittate; ovary globular; style short and thick; stigmata circinate, revolute. *Fruit* apparently small, globular, very suddenly beaked, 12 mm. in diameter (not quite mature); scales in 15 series, channelled along the centre, straw-yellowish, shining, with a broad, pale, erosely-denticulate margin, and a dark spot on the very obtuse point.

HABITAT.—Pulo Penang (*Griffith*), where it has been found again by *Gaudichaud* and more recently by *Curtis* and by *Ridley* at Moriot Road (Ridley No. 19466 in

Herb. Kew. and Calcutt.). Griffith gives the Malayan name of "Rotang Kichum." The analogous name "R. Kusom" is applied in Pangkore to *D. petiolaris.*

OBSERVATIONS.—Of this species I have seen the type-specimens in the Herbaria of Kew, St. Petersburg and Calcutta, but they are all in a very fragmentary state, and with female spadices only, while those of Gaudichaud preserved in the Herb. Delessert at Geneva and in Florence (Herb. Webb) and Paris, which have been studied also by Martius, bear male spadices only without the outer spathe. My description of the male-spadix and flowers is derived from Gaudichaud's specimen.

Ridley's specimens (No. 9466) have a portion of a leaf (probably from the intermediate part of the stem) with numerous, closely-set, equidistant leaflets, which are very long and narrow (30—35 cm. in length, 12–13 mm. broad) with almost parallel margins from a little above the base, where they are very suddenly backwardly plicate; the mid-costa underneath is very finely bristly-spinulous from base to apex. The spadices of these specimens are male only, and are somewhat larger than those represented in Griffith's plate. The outer spathe in one specimen is nearly 40 cm. long (including the beak), and is armed with numerous, long, slender, often criniform spines, which are deflexed, especially those along the centre; the beak itself is in length one-fourth of the entire spathe; the second and third spathes are armed on their upper parts with erect slender spines which are callous at the base.

Owing to the incompleteness of the type-specimens I must acknowledge that I have not a very clear idea of this species. It seems to me very closely related to *D. petiolaris* from Malacca, of which it is perhaps the representative form in Penang; it differs, however, from this in its leaflets being not distinctly 3-costulate and perhaps in its comparatively large male flowers, and also in the very few-flowered female spikelets. Griffith describes the leaflets of *C. Lewisianus* as having the mid-costa bald on the lower surface, and really in a portion of a leaf from an authentic specimen in the Calcutta Herbarium, the line of close small bristles along the mid-costa on the lower surface is wanting, and only a few of them may be seen near the apex; I have observed the same fact in the St. Petersburg specimens, while in those of Gaudichaud, which have been referred by Martius, as also by myself, to *D. Lewisianus*, the bristles are rather numerous, but apparently they are deciduous in old leaves.

The diagnostic characters of *D. Lewisianus* are:—*Stem* non-scandent. *Leaf-sheaths* armed with long, laminar, subulate scattered or subseriate non-confluent spines; leaflets of the lower leaves narrow, numerous, equidistant, rather close set, not distinctly 3-costulate; spadices rather closely approximate to the apex of the plant, axillary (in appearance), very shortly peduncled; outer spathe armed with scattered long slender spines, the beak comparatively short; partial inflorescences of the female spadix with very few, few-flowered spikelets; involucrophorum 2–3 mm. long; areola of the neuter flower suborbicular with a semi-circular swollen border. *Fruit* spherical, small, suddenly beaked.

PLATE 30.—Daemonorops Lewisianus *Mart.* Portions of a leaf and a male spadix from Gaudichaud's specimen (Paris Herbarium). The two fruits are from Lewis and have been added by Martius himself in the Paris Herbarium.

27. DAEMONOROPS PETIOLARIS Mart. Hist. Nat. Palm. iii, 326, pl. Z. XVIII, f. III (diagr.); Miq. Fl. Ind. Bat. iii, 87; Walp. Ann. iii, 475 and v, 827; Hook. f. Fl. Brit. Ind. vi, 466; Becc. in Rec. Bot. Surv. Ind. ii–221.

D. petiolaris var. *nudipes* Becc. l.c.

D. calicarpus (non Mart.) Ridley, Mat. Fl. Mal. Penin. ii, 17 pro parte).

Calamus petiolaris vars. *a* and *β* Griff. in Calc. Journ. Nat. Hist. v, 93, and Palms. Brit. India, 101, pl. CCXVI, f. VII; H. Wendl. in Kerch. Palm., 237; Miq. De Palm. Arc. Ind., 28?

DESCRIPTION.—Small, erect. *Sheathed stem* 15–20 mm. in diameter. *Leaf-sheaths* (of the upper part of the plant) not or very slightly gibbous above, obsoletely longitudinally costulate, usually armed with solitary, scattered, flat, laminar, 10–15 mm. long, subulate, brown-spadiceous or blackish, ascendent or deflexed spines. *Ocrea* very short, exactly horizontally truncate. *Radical leaves* not cirriferous, considerably larger than the upper ones, about 2 m. long in the pinniferous part and with an unusually long petiole which is terete and armed towards its base with seriate spines and smooth higher up or with straight dentiform prickles on the margins, and with a line of claws along the centre of the dorsum in the upper part. *Leaflets* very elongate, linear, the largest 40–50 cm. long, 15–20 mm. broad, subconcolorous on both surfaces, slightly narrowing to the base, where very suddenly backwardly plicate, acuminate from near the apex into a subulate tip, tricostulate above where the mid-costa is robust and acute, the side costae more slender and more closely spinulous especially towards the apex; on the lower surface the mid-costa alone very closely and finely bristly from the base to the apex, the side nerves slender and glabrous; the margins closely spreadingly, finely ciliate. *Upper leaves* of the flowering part of the plant, much reduced in size and quite different from the radical ones, cirriferous, 20–40 cm. long. including the slender cirrus; petiole very short, 1–4 cm. long, flattened plano-convex, its margins acute, smooth or prickly, the dorsum armed along the centre with approximate small slender claws, which are solitary at first and become 2–3-nate along the rachis and half-whorled on the cirrus; leaflets rather numerous, 20–25 on each side, approximate, equidistant, very small, linear or linear-lanceolate, 5–15 cm. long, 4–5 mm. broad; on the upper surface the mid-costa alone usually carrying a few bristles; underneath the mid-costa very closely and minutely bristly; margins closely spreadingly ciliate. *Spadices* crowded at the apex of the plant, before flowering fusiform-elliptical, rather ventricose or fusiform-ovoid, rather shortly beaked, 12–25 cm. long, inserted near the mouth of their sheaths, erect, supported by a short prickly or almost smooth pedicel; outermost spathe obsoletely 2-keeled, more or less covered with a very dark or tobacco-coloured scurfy pubescence, rather suddenly narrowing into a beak which is only a third or fourth part of its entire length, rather densely armed with long, rigid, very narrowly laminar or acicular, brown-spadiceous or blackish, usually straight, solitary or slightly confluent, spreading or deflexed spines,; the second and third spathes spinous only near the apex, slightly shorter than the first; the others unarmed. *Male spadix* (when not enveloped by the spathes) densely panicled-thyrsoid; partial inflorescences densely thyrsoid-cupressiform, decompound, or with many secondary branchlets; the latter 3–4 cm. long, each bearing 4–5 spikelets on each side; spikelets short, 10–18 mm. long with 2–4 flowers on each side; their axis sinuous, ferrugineous-pubescent; spathels bracteiform, small, acute; involucre distinctly callous at its axilla, deeply cupular, the third part the length of the calyx, truncate and usually distinctly 2-denticulate. *Male flowers* oblong, obtuse, 5·5 mm. long, 1·5 mm. broad, rusty-furfuraceous; the calyx tubular-campanulate, rather strongly striately-veined externally, distinctly 3-toothed, its margin ciliate-furfuraceous, especially on the apex of the teeth; the corolla twice as long as the calyx, divided down for two-thirds of its length into three narrow, rather acute, externally striolate segments; stamens with filaments united halfway up the corolla; rudimentary ovary very small. *Female spadix* . . . . .

HABITAT.—The Malayan Peninsula at Malacca, (*Griffith*). In the district of Perak at Pangkore, *Ridley* No. 7397 in Herb. Calcutt. and Beccari. Malayan name "Rotang Kusom" (Ridley).

OBSERVATIONS.—Griffith has distinguished two forms of *C. petiolaris*, but probably considering the great variability in the individuals of *Daemonorops* of the group of *Cymbospathae*, and the extraordinary differences in the leaves of this species, depending on their different situations, at the base of the stem, along it or at its apex, probably there are not sufficient reasons for keeping the two forms distinct.

I have seen portions of Griffith's authentic specimens of both, but in those of var. *α* at Kew the petiole is wanting. The specimens of var. *β* have a portion of the petiole, which is terete and 6–8 mm. in diam.; it is described by Griffith as wholly unarmed in its upper portion, while in var. *α* it is said to be prickly at the margins and clawed beneath. I suppose, however, that really the radical leaves have a very long terete petiole, in its upper part quite smooth, and that the leaves of the lower part of the stem, forming the passage to those of the apex, though also provided with a long petiole, have this more armed than the radical ones. In the spadix, spathes and flowers of the two varieties I have observed only very trifling differences.

D. petiolaris is certainly related to *D. calicarpus*, but it seems to me sufficiently distinguished by its leaf-sheaths armed with scattered, non-confluent, and not seriate spines, and by the outer spathes being much less covered with spines, and these of the usual kind, not bristly.

PLATE 31.—Daemonorops petiolaris *Mart.* From Ridley's No. 7897 in the Calcutta Herbarium.

ANN. ROY. BOT. GARD. CALCUTTA VOL. XII.

28. **DAEMONOROPS MICROTHAMNUS** Becc. in Rec. Bot. Surv. Ind. ii, 221; Ridley Mat. Fl. Mal. Penin. ii, 175.

DESCRIPTION.—Erect, very small. *Sheathed stem* 1 cm. in diameter. *Leaf-sheaths* of the upper part of the plant not gibbous above and only slightly swollen at the base of the petiole, more or less distinctly longitudinally striate and costulate, the surface rusty furfuraceous-subtomentose, sparingly armed with very weak, small, laminar or sub-bristly scattered spines; the mouth spineless. *Ocrea* very short, exactly horizontally truncate. *Radical leaves* . . . . *Leaves* of the upper and fertile part of the plant very small, shortly cirriferous, 10–15 cm. long in the pinniferous part; the petiole spineless, very short, 1–2 cm. long, flattened, plano-convex, with very acute margins; rachis armed beneath along the centre of the dorsum with solitary, straight, slightly deflexed prickles and showing an acute salient angle and flat side-faces above; leaflets rather numerous, 22–25 on each side, equidistant, closely set, very small, linear, 4–5 cm. long, 2–3 mm. broad, slightly narrowing to the base and gradually acuminate to a finely subulate and bristly tip; on the upper surface the mid-costa alone bearing a few comparatively large bristles near the apex; on the lower surface quite smooth or with very few small bristles along the mid-costa; margins with very few cilia near the apex, otherwise smooth. *Spadices* crowded at the summit of the plant, before flowering ventricose-fusiform, rather shortly beaked, 10–12 cm. long, inserted near the mouth of their sheaths, erect, supported on a short, slender, smooth, pedicellar part; outermost spathe obsoletely two-keeled, more or less covered with a very dark or tobacco-coloured scurfy pubescence, rather suddenly narrowing into a beak, which is only the third or fourth part of the length of the body, sparingly armed with very fine, weak, scattered, bristle-like, spreading or deflexed spines; all the other spathes unarmed. *Female spadix* with very few (3–4), very small, slightly rusty-furfuraceous partial inflorescences, each of which is composed of only 2–3 very depauperate and few-flowered spikelets; secondary spathes bracteiform, very acuminate; spathels bracteiform, broadly triangular, acute or acuminate at one side, about as long as or longer than the involucrophorum; the latter sub-obconical, short and thick, broadened at the summit into an asymmetrical subcupular limb, acute or acuminate at one side, its tip exceeding the rim of the involucre which is cupular, usually slightly produced and acute on the side of the neuter flower; areola of the latter very distinct, concave, suborbicular with a more or less semicircular border *Female flowers* ovoid-oblong, 5 mm. long, 3 mm. thick; the calyx cylindraceous, superficially 3-denticulate; the corolla less than twice as long as the calyx, its segments elongate, triangular, acute. *Fruiting perianth* explanate. *Fruit* small, globular, shortly gradually conically and acutely beaked, 12 mm. in diam.; scales in 15 longitudinal series, broadly and not deeply channelled along the centre, rather dull, with polished apex, tawny, with a rather broad discoloured margin and a faint and narrow intramarginal line; the apex regularly triangular, acute or somewhat blunt. *Seed* globular.

HABITAT.—The Malayan Peninsula, where collected in the district of Perak by *Father Scortechini.*

OBSERVATIONS.—This is the smallest of all known *Daemonorops*, but probably it is nothing more than a diminutive form of *D. petiolaris.* The latter however is known from male plants, and *D. microthamnus* from female ones. The much less spinous outer spathe, the leaf-rachis armed beneath with solitary straight prickles, the leaflets with the mid-costa alone setigerous on the upper surface and their margins with only 2–3 long cilia near the apex, and the very small dimensions of its vegetative parts, are characters that may depend upon nanism and are of little value if not accompanied by essential differences in the reproductive organs and especially in the fruit, but the fruit of *D. petiolaris* is unknown.

On the outer spathe of *D. microthamnus*, as on that of *D. petiolaris*, the usual pulverulent or scurfy indumentum is accompanied by a kind of coarse pubescence, which I have observed only in those two species and in *D. tabacinus*.

PLATE 32.—Daemonorops microthamnus *Becc.* Scortechini's specimens in Herb. Beccari.

29. DAEMONOROPS TABACINUS Becc. in Hook. f. Fl. Brit. Ind. vi, 466, and in Rec. Bot. Surv. Ind. ii, 222.

DESCRIPTION.—Small, erect 0·7–1 m. high. *Sheathed stem* about 2 cm. in diam. Almost every part of the plant, even the spines, covered more or less abundantly with an adherent furfuraceous scurf of a very dark tobacco colour. *Leaf-sheaths* armed with feeble, scattered, laminar, subulate, seriate but individually distinct spines; the mouth smooth. *Ocrea* very short, exactly horizontally truncate. *Radical leaves* non-cirriferous, elongate, considerably larger than the upper ones, and with a very long petiole which is terete, 6–7 mm. in diam., densely armed towards its base with long flat obliquely and closely seriate spines and nearly smooth higher up, except for a few spines along the centre of the dorsum. *Leaflets* very numerous, equidistant, rather closely set, very narrowly linear, dull on both surfaces, more or less punctulate-furfuraceous on the lower surface, 23–28 cm. long, about 1 cm. broad, rather firm, with the mid-costa and one rather distinct nerve on each side of it bristly-spinulous on the upper surface; on the lower the mid-costa alone very finely and closely ciliate from the base to the apex; the margins finely, closely and spreadingly ciliate. *Upper leaves* considerably smaller than the lower ones (40–50 cm. long), shortly cirriferous; the petiole gradually shorter, in one specimen of the intermediate part of the stem 30 cm. long, in the higher part, flat and finely scabrid above, armed on the margins with long, solitary, rather remote, horizontal or subdeflexed spines, and on the dorsum with straight or slightly hooked, 1 cm. long prickles, that are solitary at first, becoming on the rachis more claw-shaped and 3-nate, with the central usually longer than the lateral; leaflets similar to those of the radical leaves, but shorter and more rigid, neatly and closely pectinate, the largest 15–20 cm. long, and 1 cm. broad, in the uppermost leaves 5–12 cm. long, 5–8 mm. broad with the bristles on the mid-costa on the lower surface less numerous than on the radical leaves, on the upper surface usually on the central costa alone; the margins more or less deciduously spreadingly ciliate and bearing traces of the general tobacco-coloured scurf. *Spadices* ventricose-fusiform, or very broadly elliptical, suddenly contracting into a very narrow beak which is longer or at least as long as the body, supported by a very short, smooth, or marginally prickly pedicel; outermost spathe very broadly cymbiform, covered with a very dark tobacco-coloured scurfy pubescence, armed on the back with numerous and closely packed, very narrowly laminar and sub-criniform, dull, furfuraceous, brittle, elongate (2–3 cm. long) spiculae, that are solitary or confluent and comb-like, especially on the keels and at the base of the beak; second and third spathes not distinctly keeled, spinous only near the apex, also furfuraceous externally. *Male spadix* with the outer spathe in one specimen 47 cm. long, including the beak, the beak itself spinous only at its base and about 27 cm. long; the flowering panicle densely thyrsoid-ovoid with 5–6 partial inflorescences; the latter rather broad, 7 cm. long, with rather spreading flowers and carrying about 10 branchlets, each with 5–6 spikelets on either side; spikelets densely rusty-furfuraceous, small, the largest—the lowest of every branchlet—about 1 cm. long, with 3–4 flowers on either side; secondary and tertiary spathes elongate-triangular, acuminate; spathels bracteiform, triangular, acute, about as long as the involucre; the latter comparatively large, cupular, bidenticulate, frequently subcymbiform with an acute tooth on each side. *Male flowers* oblong, obscurely trigonous, slightly narrowing towards the apex, but obtuse, 5–6 mm. long, 2 mm. thick, the calyx tubular-cylindraceous, superficially 3-dentate; the corolla twice as long as the calyx. *Female spadix* short and dense, the partial inflorescences very approximate, with very short and depauperate spikelets, that bear 2–3 flowers only, or are reduced even to a single flower; the axial parts very short and approximate and densely rusty-furfuraceous; spathels with a comparatively large obliquely evolute limb; involucrophorum obliquely obconical or sub-infundibuliform with a very short pedicellar part, extended at one side into a very broad triangular acute point, which slightly surpasses its spathel; involucre rather deeply cupular, truncate, slightly emerging from the involucrophorum; areola of the neuter flower distinct, suborbicular, with a semi-circular swollen border on its upper part. *Fruiting perianth* not quite explanate, broadly obconical; the calyx very strongly striate, pluri-costulate; the corolla twice as long as the calyx. *Fruit* (when not quite mature) globose-ovoid, conically beaked and crowned with the rather elongate, subulate stigmas, 13 mm. in diam.; scales in 15–16 longitudinal series, very glossy, straw-yellowish, slightly and broadly channelled along the middle, with lighter margins and an indistinct and narrow intramarginal line; tip very obtuse, dark-spotted. *Seed* not seen when quite mature.

HABITAT.—The Malayan Peninsula, at Larut in the district of Perak (*King's collector* No. 2537 in Herb. Calcutt.).

OBSERVATIONS.—It is allied to *D. petiolaris*, but it appears quite distinct from that by the unopened spadix being more ventricose and suddenly narrowing into a beak longer, or at least, as long as the body, and by the very dark tobacco-coloured scurf with which the plant is covered in almost every part.

PLATE 33.—Daemonorops tabacinus *Becc.* The type specimens No. 2537 in the Calcutta Herbarium.

30. **DAEMONOROPS CALICARPUS** Mart. Hist. Nat. Palm. iii, 326, pl. 175, f. vi, and pl. Z xviii, f. vii; Miq. Fl. Ind. Bat. iii, 87; Walp. Ann. iii, 475 and v, 827; Hook. f. Fl. Brit. Ind. vi, 466; Becc. in Rec. Bot. Surv. Ind. ii, 222; Ridley, Mat. Fl. Mal. Penins. ii, 174 (excl. syn.).

Calamus calicarpus Griff. in Calc. Journ. Nat. Hist. v, 92, and Palms Brit. Ind. 99, pl. CCXV, A. B. C. D. and pl. CCXVI, f. vi; H. Wendl. in Kerch, Palm. 235.

DESCRIPTION.—Erect or subscandent, rather slender. *Sheathed stem* 2·5–3 cm. in diameter, the internodes short. *Leaf-sheaths* rusty furfuraceous, those of the lower part of the plant not gibbous above and more or less open on the ventral aspect and densely armed with very approximate, almost complete, oblique circles or series of long (up to 3–4 cm.) narrowly laminar, subulate, ascendent spines, with smaller series often incomplete of sub-bristly spiculae, erect or sometimes reflexed on the dorsum and interposed between the larger series; the spines near the mouth and at the base of the petiole longer than elsewhere; on the upper part of the stem the sheaths are truncate, not or very indistinctly gibbous above and very short, the leaves being very approximate. *Ocrea* very short, truncate. *Leaves* very variable according to their position; the lower ones 1–1·7 m. long, including the petiole, not or very shortly cirriferous; petiole 30–45 cm. long, channelled near the base, flat and smooth above in its upper part, rounded on the lower aspect, and armed along the dorsum with long, laminar, straight, subulate, solitary or more frequently geminate or 3-nate, deflexed spines; similar spines but pointing upwards are present on the rather acute margins; in the upper leaves the petiole gradually becomes shorter and flatter above and with shorter spines; rachis smooth throughout, bifaced with a salient angle above only near its apex, strongly convex on the lower surface and rather closely armed with slender, ternate, often rather straight claws that become still closer and 5-nate on the slender cirrus. *Leaflets* rather numerous, approximate, equidistant, elongate, linear, rather suddenly narrowed to the base, long-acuminate into a very slender subulate setiform apex, almost concolorous on both surfaces, on the upper the mid-costa acute, bristly towards the apex and with a rather distinct secondary nerve on each side of it, bristly from about the middle upwards; underneath the mid-costa very closely and finely bristly, and occasionally accompanied by a secondary nerve on each side also bearing a few bristles; margins closely ciliate-spinulous; the largest leaflets, those of the lower leaves, 30–40 cm. long and 12–15 mm. broad; the leaves of the upper and spadicigerous part of the stem shortly petioled or subsessile, much smaller than the lower ones, 0·5–1 m. long, including the cirrus, bearing few linear very narrow (4–6 mm. broad) leaflets that are sparingly bristly or even glabrous above, but on the lower surface the mid-costa minutely and closely bristly as usual. *Spadices* before flowering fusiform, rather shortly beaked, apparently axillary, all approximate towards the summit of the stem, very variable in size, in the largest specimens as much as 40–50 cm. including the beak, but usually 25–30 cm. only, erect, supported by a short, flat, bristly-spinulous peduncular part; outer spathe fusiform-elliptical, the beak a third or fourth as long as the body, very densely covered with innumerable, often confluent and interruptedly seriate, 3–4 cm. long, flexible coarse or criniform, flattened bristles, which are often undulate or almost crisp, usually discoloured, pale straw-yellowish, grayish or of a light chestnut-brown colour, more rarely darker, erect or pointing in different directions and even deflexed, especially near the beak, which is in a great part covered with them; the second spathe is also covered with the same kind of bristles, but in a lesser degree; the third is crinite only towards the apex. *Male spadix* with a very densely cupressiform panicle, bearing 5–6 partial inflorescences, rusty furfuraceous in every part; secondary spathes amplectent, bracteiform, triangular, acute or acuminate; partial inflorescences divided into 5–7 alternate branchelets; each of these with many small spikelets which bear 4–5 flowers on each side; axis of the spikelets strongly zig-zag sinuous; spathels bracteiform, triangular, acute at one side; involucre a third as long as the calyx, exactly cupular, truncate, striately veined externally, the margin not ciliate, with two small acute teeth on the side next to the axis and with a distinct axillary callus. *Male* *flowers* elongate-oblong; the calyx campanulate with 3 short teeth that are furnished with a brush of rusty furfuraceous filaments at the apex; corolla about twice as long as the calyx. *Female spadix* (when not enveloped by the spathes) short, usually 15–20 cm. in length, but sometimes, especially in the higher part of the plant, not more than 8–12 cm. only; the joints of the main axis stout, short and tumescent in their basal part; partial inflorescences very short, 5–6 cm. long and with only 2–4 alternate spikelets on each side; secondary spathes bracteiform, amplectent, acuminate, very finely veined; spikelets short, their axis thick, angular, zig-zag sinuous, furfuraceous when young, later glabrous, the joints very short; spathels bracteiform, triangular, acuminate, about as long as their respective involucrophora; the latter obconical, thick, angular, 3–4 mm. long, with a distinct axillary callus, a deep transverse fovea and an oblique subspathaceous and unilaterally acute limb; involucre cupular, truncate, usually asymmetric or slightly extended on the side of the neuter flower, slightly exserted from the involucrophorum; areola of the neuter flower conspicuous, with a very distinct, tumescent, semicircular upper margin. *Neuter flowers* flattened, 4 mm. long, very similar to the male ones. *Female flowers* about 5 mm. long and 3 mm. thick; the calyx, suburceolate, striately veined, superficially 3-toothed, teeth surmounted by a brush of rusty filaments; the corolla not quite twice as long as the calyx, divided down almost to the base into 3 ovate-lanceolate, subacute, and indistinctly striate segments; staminal urceolum almost as long as the calyx, crowned by 6 very short teeth; anthers small, sagittate. *Fruiting perianth* almost explanate. *Fruiting* spadix densely and broadly panicled. *Fruit*—when quite mature—spheric, suddenly conically and acutely beaked, 18–20 mm. in diam., ovoid when young; scales in 18 series, rather dull, of a light brown or tawny colour, not deeply chanelled along the centre with a narrow darker, sometimes indistinct, intramarginal line, the margin lighter and not very distinctly erosely toothed, the apex obtuse. *Seed* globular, very slightly flattened, albumen white, ruminate; embryo basal.

HABITAT.—The Malayan Peninsula (*Griffith*). Found again in the district of Perak by *Father Scortechini* No. 320^b in Herb. Beccari; and at Lumut, by *Sir G. King's collector* No. 7899 in Herb. Calcutt.

According to Griffith the main plant receives the Malay name of "Rotang chochoor minia" and the female one that of "R. chochoor" only. Scortechini gives the name of "R. dudu" which means the "sitting (not climbing) Rotang".

OBSERVATIONS.—Closely related to *D. petiolaris*, and like that, has the radical leaves much larger than the upper ones, but distinguishable by the leaflets being not distinctly 3-costulate; by the outer spathe being covered with innumerable, seriate, long, bristly or criniform, usually crisp or undulate spiculae, and by the leaf-sheath bearing numerous approximate series of long confluent delicate spines.

PLATE 34.—Daemonorops calicarpus *Mart.* From Scortechini's No. 520^b in Herb. Beccari.

31. DAEMONOROPS URSINUS Becc. in Rec. Bot. Surv. Ind. ii, 22.

DESCRIPTION.—Scandent, slender. *Sheathed stem* 15–18 mm. in diam. *Leaf-sheaths* not or very slightly gibbous above, entirely and irregularly covered with very long (up to 5–6 cm.) rigid, brittle, hair-like, blackish or spadiceous, closely seriate spiculae, and clothed with a dense, dark brown, woolly scurf, which clothes also the petiole and the leaf-rachis; the mouth is furnished with two erect, rigid, stipuliform, very slender appendages, which attain the extraordinary length of 20–25 cm., are about as thick as a pack-thread and are covered like the sheaths with the same kind of spreading, confluent and close verticelled, criniform hairs. *Leaves* 0·9–1 m. long (including the petiole), subcirriferous, bearing small, gradually diminutive leaflets to the very apex; petiole about 20 cm. long, subterete or slightly flattened-biconvex, comparatively robust (6–7 mm. thick); rachis bifaced with a salient angle above, towards the base convex on the lower surface which is scurfy-furfuraceous throughout and like the petiole covered with the same kind of blackish criniform hairs that cover the sheaths, and armed with light coloured black-tipped claws, scattered and solitary on the petiole and digitate—often irregularly—on the rachis. *Leaflets* very numerous, very regularly and closely set, inserted at a very wide angle or subhorizontal, thinly papyraceous or submembranaceous, green, slightly paler on the lower surface, narrow, linear, slightly narrowing towards the base and from about the middle gradually acuminate to a subulate and bristly tip, with 3 bristly slender costae on the upper surface, the mid-costa on the lower surface and the margins uniformly covered with light, delicate, spreading hairs; transverse veinlets very sharp on the upper surface; the largest leaflets, the intermediate ones, about 15 cm. long, 6–10 mm. broad, the upper ones gradually smaller, and those near the apex very narrow and quite rudimentary. *Male svadix* erect, very small, axillary in appearance, narrowly fusiform, 12–15 cm. long; outer spathe gradually narrowing into a slender and not very long beak, furfuraceous and covered like the other parts of the plant with criniform hairs; the flowering panicle small, glabrous in every part, with few, very small, partial inflorescences, each bearing very few and very few-flowered spikelets; spathels bracteiform, amplectent, very broad, acute; involucre subcymbiform and apparently formed by two very broad, ovate, acute bracts, connate by their bases. *Male flowers* small, broadly ovate, obtuse, irregularly and obsoletely trigonous, 3 mm. long; the calyx finely striately veined, broadly and not deeply 3-toothed; the corolla about twice as long as the calyx.

HABITAT.—Borneo. I discovered this very curious and distinct species near the summit of Mount Mattang in Sarawak in December 1866; (P. B. No. 2925).

OBSERVATIONS.—This species stands quite alone in the group of *Cymbospatha*, on account of the two curious stipuliform appendages that arise erect from the mouth of the leaf-sheaths, one on each side, at the base of the petiole; it is also easily distinguishable from all other species known to me, by the long, rigid, criniform hairs covering the sheath, petiole, and spadix, which are also clothed with a dense brown woolly scurf; by the subcirriferous leaves with small narrow leaflets carrying delicate light hairs on their margins, on the mid-costa beneath and on 3 costae above; and by the flowering axis of the male spadix being quite glabrous in every part, with few branchlets and very few-flowered spikelets, and finally by the small broadly ovate-trigonous flowers.

PLATE 35.—Daemonorops ursinus *Becc.* The type specimen P. B. No. 2925 in Herb. Beccari.

32. **DAEMONOROPS MACROPTERUS** Becc. in Rec. Bot. Surv. Ind. ii, 223.

Calamus (Sect. *Daemonorops*) *macropterus* Miq. de Palm. Arc. Ind. 19 and 29; H. Wendl. in Kerch. Palm. 236.

DESCRIPTION.—High scandent, very large and robust. *Sheathed stem* 7–8 cm. in diameter. *Leaf-sheaths* woody, densely armed with numerous, deflexed, flat, rigid, dull, furfuraceous, blackish, irregularly seriate, long and formidable (3–6 cm.) spines, intermixed with others that are smaller and ascendent. *Leaves* very large, about 4 m. long in the pinniferous part, terminating in a very robust cirrus 2 m. long; the petiole is very robust, 50 cm. long, 3 cm. broad, flat on the upper surface and very densely armed with erect, rigid, flat, straight, scattered or irregularly seriate spines, lower surface convex and also armed with numerous straight, flat, usually deflexed spines; the very robust rachis on the lower surface is convex and armed in its first portion with small, scattered, confluent, and irregularly seriate claws; higher up, and especially towards the apex and on the cirrus, these are united by their swollen bases, so as to form at regular distances, half-whorls of 6–10 each; the salient angle on the upper surface of the rachis is copiously furnished with small ascendent prickles. *Leaflets* large, numerous, equidistant, ensiform or narrowly lanceolate; the middle leaflets 60–65 cm. long, 3·5–4 cm. broad, papyraceous, green and concolorous on both surfaces, broadest not very far above the base, and thence very gradually narrowing to a subulately acuminate tip; the mid-costa is moderately thick, acute, bristly spinulous near the tip and has a single slender nerve on each side of it furnished with moderately long bristles; on its under surface the mid-costa has from the middle upwards rather long but remote bristles; transverse veinlets very minute, very approximate, and sharp; margins closely, minutely, and appressedly spinulous. *Male spadix* before flowering nodding on a rather elongate pedicellar part, otherwise straight and rigid, terete and not thicker than a man's finger (14–16 mm.), 60–85 cm. long, including the pedicellar part which is 25–30 cm. long and passes very gradually into the outermost spathe, is flattened and very densely armed with acicular, flat, scattered or fascicled, irregularly set, erect, spreading or deflexed, 1–2 cm. long spines; the outer spathe is very narrowly lanceolate, almost flat, and with revolute margins; after flowering, it is coriaceous, very rigid, and gradually narrows to an acuminate tip, externally it is not (or only obsoletely) two-keeled, but is quite covered with a soft greyish-brown, furfuraceous indumentum; it is also armed, sparingly on the body but strongly towards the base, with thin, laminar, elastic spines, similar to those of the pedicellar part but longer; the apex is also more or less furnished with acicular spines; internally it is glabrous, of a reddish cinnamon-brown, and is distinctly and longitudinally striate; the inner spathes are also coriaceous, linear, elongate, protruding gradually about 2 cm. one above the other; externally rusty furfuraceous, acuminate, and with a few acicular sub-bristly spines at their apex; internally similar to the outer spathe. The flowering panicle is about 40 cm. long, very slender and strict, with 5 small erect, very slender, appressed, cupressiform, partial inflorescences; the main axis is cylindraceous, glabrous, and very slender, marked by depressions caused by the flowers; the largest partial inflorescences are 8–9 cm. long and have a few small branchlets which bear a very few unequal spikelets of but few flowers each; the largest spikelets—the lower ones—are 8–10 mm. long, and have only 6–8 irregularly set flowers; their axis is extremely slender and capillary; spathels inconspicuous; involucre very small, discoid, orbicular. *Male flowers* small, 4–5 mm. long, asymmetrically subtrigonous-lanceolate, acuminate; calyx very small, deeply 3-dentate; petals lanceolate, sinuous, acuminate, several times longer than the calyx; stamens longer than the corolla, anthers basifixed, linear-sagittate; pollen yellow, like sulphur powder. *Female spadix* elongate, rather slender, cupressiform; the panicle in one specimen is 65 cm. long (without the pedicellar part) and bears 6–7 partial inflorescences; the axis is rigid, somewhat flattened, 7–8 mm. broad at its base; the partial inflorescences are erect, appressed to the axis, 6–10 cm. apart and each 15–20 cm. long with 8–10 spikelets that are somewhat irregularly distichous; secondary spathes very short, reduced to a very narrow membranous ring, acute or acuminate at one side; spikelets erect, slender, 6–8 cm. long, conspicuously rusty-furfuraceous; their axis angular, slender, sinuous; spathels very shortly annular; involucrophorum elongate, pedicelliform, 3–5 mm. long, trigonous, with a very short limb; involucre very slightly raised above the involucrophorum and having a very rudimentary annular limb surrounding the relatively large and convex disk upon which the female flower rests; the areola of the neuter flower is niche-like and elongate. *Fruiting perianth* very broadly obconical; the calyx has 3 broadly triangular, acute teeth; the segments of the corolla are also very broadly triangular, callous and smooth at their base, otherwise strongly, striately veined. *Fruit* ellipsoidal, 2 cm. long, 15 mm. broad, shortly conically beaked, crowned with the remains of the 3 small stigmas; scales arranged in 15–16 longitudinal series, of a shining light greenish-yellow or straw colour, narrowly but deeply channelled along the centre, otherwise convex; the margins very narrow, and, like the blunt point, slightly darker and dull. *Seed* ovoid, with a flattish base, more convex on the outer than on the raphal side; the chalazal fovea remains almost in the centre of the raphal side forming a cylindrical pit that penetrates to the centre of the albumen; the latter bony and ruminate with very narrow black channels.

HABITAT.—Menado in Celebes (*Reidel*). Vernacular name "Angah".

OBSERVATIONS.—Of this species I have seen the authentic specimen in the Herbarium of Buitenzorg and a portion of it in that of Utrecht. Moreover, I have received, from the Botanic Garden of Buitenzorg, a male spadix and a leaf of a plant cultivated there under the name of "*Calamus macropterus* Miq.—Angah—Menado", which almost certainly has the same origin as the specimen upon which Miquel founded the species. I must observe, however, that the portions of the leaves which in the Herbaria of Buitenzorg and Utrecht accompany the fruits of *D. macropterus*, and correspond to the description of Miquel, are quite different from those of the male plant cultivated at Buitenzorg under that name, and apparently belong to another species.

It is therefore safe to consider *D. macropterus* as founded only on the fruiting specimen described above, and reproduced in Plate 37, and to wait for further evidence as to conspecificity of the male plant of which I have also given the description.

Plate 36.—Daemonorops macropterus *Becc.* An intermediate portion of a leaf, under surface. Portion of the petiole of a leaf with the apical part of the leaf-sheath. An entire male spadix (in two pieces) before the opening of the spathes. A male spadix after the anthesis with the lowest spathe *in situ.* From the plant cultivated at Buitenzorg under the name of *C. macropterus* Miq.

Plate 37.—Daemonorops macropterus *Becc.* The fruiting spadix, and the portion of the leaf which accompanies it in the Herbarium at Buitenzorg. These are portions of the type specimen upon which Miquel established his *Calamus macropterus.*

33. **Daemonorops Sarasinorum** Warb.; name only in Herb. Berol.

Description.—Very large and robust. *Sheathed stem* apparently 6–7 cm. in diam. *Leaf-sheaths* extraordinarily and very densely covered with innumerable, unequal, often very long (up to 5–6 cm.), black, elastic, very narrowly laminar, rigid or needle-like, also criniform spines. *Leaves* very large; rachis in the intermediate portion flattish and remotely clawed on the lower surface; on the upper surface roundish or with a very obsolete or obtuse angle, rather densely armed at the sides and along the centre with short, rigid, ascendent spines. |*Leaflets* numerous, equidistant, rather closely and very spreadingly set, narrowly ensiform, suddenly diminishing towards the base, about 50 cm. long and 2 cm. wide in their broadest part,—8–18 cm. above the base—and thence very gradually acuminate to a long, subulate and bristly tip, somewhat firmly papyraceous, green, concolorous and dull on both surfaces, rather distinctly 3-costulate; the mid-costa acute and the side costae slender, all three more or less bristly on the upper surface, but the mid-costa alone bristly from the middle upwards on the lower surface; transverse veinlets minute, short, approximate and rather distinct on both surfaces; the lower margin is rather distinctly thickened and has a very narrow polished band on the upper surface; margins rather closely and spreadingly bristly-ciliate. *Male spadix* supra-decompound, narrow and elongate-cupressiform with several, erect, compact or densely flowered—appressed, strict, gradually diminishing partial inflorescences; spikelets covered with an abundant furfuraceous indumentum, the largest (the lowest of each branchlet) are about 2 cm. long, and have 10–12 irregularly set flowers; the axis of the spikelets is very slender and filiform; secondary spathes, spathels and involucra excessively small or obsolete. *Male flowers* short (4 mm. long), thickish, irregular, with the anthers quite exserted from the corolla even when they are still very young, and enclosed within the spathes; the calyx is very small, almost flat, trigonous or 3-toothed; the corolla is a good deal longer than the calyx, and is divided below the middle into 3 coriaceous, strongly striately-veined, asymmetrically-oblong and obtuse lobes; stamens with rather thick subulate filaments; anthers basifixed, oblong, often asymmetrical, obtuse, deeply parted or sagittate at the base; rudimentary ovary small, 3-fid. *Female spadix* elongate, strict, cupressiform, with a very short, densely spinous, pedicellar part; spathes coriaceous, tubular before flowering; the outermost apparently not much shorter than the inner ones—in one specimen 60 cm. long—fusiform, opening flat during the anthesis, narrowing almost equally to both ends, but gradually prolonged into an elongate, rigid, narrow tip, strictly coriaceous, glossy and of a cinnamon colour internally, and externally very densely covered with innumerable long, narrow, laminar, subulate, more or less irregularly confluent, black spines; inner spathes unarmed, thinly coriaceous, cinnamon-brown; axis of the spadix rigid, fugaciously furfuraceous, smooth and polished; secondary spathes very short, annular; the partial inflorescences erect, appressed to the axis, about 12–14 cm. long, with 5–6 spikelets on each side; the latter 6–10 cm. long, wih about 10 regularly distichous flowers on each side; spathels very small, scale-like, triangular, scarious, acute; involucrophorum pedicelliform, subtrigonous, 4–5 mm. long, produced at one side (in the apical part) into a small, triangular, acute, bracteiform point; involucre also pedicelliform and subtrigonous, slightly raised above the involucrophorum, disciform above; areola of the neuter flower punctiform, indistinct. *Female flowers* at the time of the anthesis 4 mm. long, exclusive of the stigmas which are exserted from the corolla and are about as long; the whole length of the female flowers is therefore about 8 mm.; calyx very short, cupular, polished (not striate), superficially 3-toothed; corolla ventricose-urceolate, strongly striately veined, coriaceous, about 3 times as long as the calyx, having 3 broadly triangular, acute teeth; the staminal urceolum lines the whole inner surface of the corolla, forms a fleshy ring at its mouth, and is crowned with 6 shortly subulate teeth; anthers erect, basifixed, sagittate, acute, exserted; ovary globular; stigmata sessile, conspicuous, fleshy, sinuous, with numerous thick lamellae on the inner side, entirely exserted from the corolla during the anthesis. *Fruit* unknown.

HABITAT.—Tomohon in N. Celebes in the Province of Minahassa (*Sarasin* No. 1082 in Herb. Berol.).

OBSERVATIONS.—A very robust, well-marked and handsome species, apparently related to *D. macropterus.* The leaf-sheaths by their very dense covering of long black, rigid, hair-like spines, resemble the back of a wild boar.

It is easily distinguishable by its very peculiar flowers, the male not having the anthers enclosed as usual within the corolla, but entirely protruding beyond it even before the flowering stage; in the same way the female flowers, at the time of the anthesis and apparently even before it, have the relatively very large stigmas quite exserted from the corolla.

PLATE 38.—Daemonorops Sarasinorum *Warb.* Portion of the leaf-sheath; an intermediate portion of a leaf; the terminal part of a male spadix with unexpanded flowers; the lower portion of a female spadix in flower and with its lowest spathe *in situ.* From the authentic specimen in the Herbarium at Berlin.

34. DAEMONOROPS ROBUSTUS Warb.; name only in Herb. Berol.

DESCRIPTION.—Scandent and apparently large. *Leaves* very large. *Petiole* . . . . ; rachis in its upper portion armed underneath with very robust, 5–7-nate claws bifaced above and with a salient, smooth angle; leaflets numerous, subequidistant, not very approximate, ensiform, somewhat narrowing towards the base, gradually acuminate to he tip, 60 cm. long, 2·5 cm. broad, papyraceous, green and subconcolorous on both surfaces, with the mid-costa acute and naked on the upper surface, accompanied by a few secondary nerves, one of which, on each side, is slightly stronger than the others, and furnished with remote bristles, especially from the middle upwards; the mid-costa alone is bristly on the lower surface; transverse veinlets very minute, approximate, and numerous, not very sharp; lower margin on the upper surface opaque, very slightly thickened; margins very remotely, indistinctly and appressedly spinulous. The upper leaflets (no others seen by me) are about 60 cm. long, 2·5 cm. broad. *Male spadix* . . . *Female spadix* apparently elongate, strict, covered with a thin furfuracous tobacco-brown indumentum; its peduncular part very densely and irregularly armed with innumerable, narrowly laminar, elastic, unequal, subulate, dark-brown spines; the main axis slightly flattened at the base and 9 mm. broad; primary spathes . . .; partial inflorescences erect, appressed to the main axis; the only one seen by me (apparently one of the lowest) is 20 cm. long, rigid, and has 5 spikelets on each side; the main axis, and the axes of the spikelets, are irregularly angular and covered with a dense, adherent, tobacco-brown scurf; secondary spathes and spathels inconspicuous, very shortly annular; the spikelets have very thick axes, are 6 cm. long, and have two slightly assurgent series of 6–7 flowers each; involucrophorum very short and thick, angular, obconical, extended at one side into a broadly triangular and short bracteiform point; involucre slightly raised above the involucrophorum, flat, discoid, with a very narrow rim; areola of the neuter flower concave and sublunate. *Fruiting perianth* explanate. *Fruit* spherical, 17–18 mm. in diam.; scales arranged in 15 longitudinal series, each series composed of six scales not taking into account the ill-conformed apical ones; they are glossy and ventricose, light greenish-yellow in colour, convex, grooved along the centre, with a very narrow, scarious, finely erose margin, and an obtuse point. *Seed* globular, deeply ruminated.

HABITAT.—Bojong in the Province of Minahassa in N. Celebes, (*Warburg* in Herb. Berol.).

OBSERVATIONS.—Apparently related to *D. macropterus*, but the fruit is spherical.

PLATE 39.—Daemonorops robustus *Warb.* The type specimen in the Herbarium at Berlin.

35. DAEMONOROPS LAMPROLEPIS Becc. in Rec. Bot. Surv. Ind. ii, 223.

DESCRIPTION.—Scandent. *Sheathed stem* about 2 cm. in diameter. *Leaf-sheaths* strongly gibbous above, covered more or less with an adherent, tobacco-coloured scurf and armed with numerous, weak, thinly laminar, sometimes laciniate, acicular, unequal, 1–2 cm. long (at times even shorter), setiform, solitary, scattered, ascendent or spreading, brown-spadiceous spines, which rise from small bulbous bases. *Leaves* about 1·5 m. long in the pinniferous part, terminating in a slender, clawed cirrus about 80 cm. long; the petiole rather short, about 12 cm. long, 10–12 mm. broad, biconvex, somewhat flattened, with acute edges, almost smooth underneath, armed on the upper surface especially near the edges with small, straight, erect, slender, acicular spines; the rachis armed along the centre of the convex dorsum with rather strong claws that become ternate near the apex, and 5-nate and half-whorled on the cirrus and have a rather strong and swollen base; on the upper surface the rachis is first convex and armed with small, ascendent prickles, becoming bifaced higher up with a salient and prickly angle. *Leaflets* numerous, equidistant, 2–3 cm. apart, and ensiform; the intermediate about 30 cm. long, 17–18 mm. broad, papyraceous, green and concolorous on both surfaces, broadest about the middle, narrowing thence to a rather acute base below and to a gradually acuminate and filamentose tip above; the mid-costa not very robust, acute, with a very few bristles, and these only near the tip; one slender nerve on each side of the mid-costa bears many long and spadiceous bristles;

a not very regular line of similar long bristles on the lower surface on the mid costa only; transverse veinlets not very distinct; margins very minutely, closely and appressedly spinulous; the lower margin bordered on its upper surface by a very narrow glossy band. *Male spadix* . . . . . *Female spadix* before flowering pendulous, very long and slender, no thicker than a man's little finger, cylindraceous, 40 cm. long (including a pedicellar part), 10–12 mm. thick; the pedicellar part itself is 12–15 cm. long and passes very gradually into the outer spathe; it is slender, flattened, armed very densely, especially towards the apex, with unequal, acicular, flat, scattered or fascicled and irregularly set, erect, spreading or deflexed spines, 1–2 cm. long; the outer spathe is coriaceous, very rigid, very narrowly lanceolate, almost flat, with revolute margins when open, and narrows to an acuminate, externally densely crinite tip; externally it is not or only very obsoletely two-keeled and covered throughout with a thin, adherent, brown indumentum, and armed sparingly, on the body, with solitary, scattered, rigid, 1–2 cm. long, criniform spiculae which rest on small bulbous bases; within it is glabrous, finely striate and of a cinnamon-red colour; the inner spathes (there are only 3) are coriaceous, elongate, narrowly-lanceolate, acuminate, and protrude very slightly and gradually one out of the other, all rusty-furfuraceous and densely crinite (externally) at their apices, elsewhere smooth. *Fruiting panicle* 20–25 cm. long, rigid, cupressiform, densely flowered, with only 3 partial inflorescences; all the axial parts are covered with an adherent, tobacco-coloured scurf; the partial inflorescences are 8–10 cm. long and have 4–6 distichous spikelets on each side; secondary spathes are reduced to a narrow scarious ring slightly produced at one side into a small triangular point; the spikelets are 3–5 cm. long, and have 4–6 irregularly distichous flowers on each side; spathels reduced to a narrow scarious ring slightly produced at one side into a small triangular acute point; involucrophorum pedicelliform, trigonous, slightly obconical, 2–3 mm. long, slightly extended at the apex into a rudimentary limb on one side; involucre slightly raised above the involucrophorum by a short and thick, angular, pedicellar part, flat above and with a very narrow and rudimentary limb; areola of the neuter flower niche like. *Female flowers* 6 mm. long, ovoid, acute; the calyx very short, subpateriform, truncate, entire, strongly veined; the corolla several times longer than the calyx, ventricose at the base, and divided to below the middle into 3 elongate-triangular, often sinuous, acuminate, and finely striate segments; the stigmas thickly subulate, shorter than the segments of the corolla during anthesis. *Neuter flowers* sinuous-lanceolate, acuminate, 5 mm. long; the calyx very shortly cupular and entire; the corolla several times longer than the calyx, finely striate. *Fruiting spadix* erect, or nodding, forming an elongate-ovoid panicle. *Fruit* ovoid-ellipsoidal, almost equally narrowing towards both ends, obtusely conic-mammillate at the apex, 15 mm. long, 11—11·5 mm. broad; scales in 15 longitudinal series, light greenish-yellow, glossy but with a very narrow, dull margin, narrowly grooved along the centre, otherwise convex, point obtuse. *Seed* ovoid, boldly tubercled and coarsely pitted; albumen ruminate.

HABITAT.—I gathered this species at Lepo-Lepo near Kandari in S. E. Celebes, July 1874.

OBSERVATIONS.—The fruit is somewhat smaller, but otherwise very similar in shape, as also in the structure and colour of the scales, to that of *D. macropterus*, to which *D. lamprolepis* in evidently related, though of much smaller dimensions.

PLATE 40.—Daemonorops lamprolepis *Becc.* Portion of the stem with a spadix before the anthesis; an entire female spadix in flower; portion of the stem with a spadix in fruit; an intermediate portion of a leaf.

36. **DAEMONOROPS NIGER** Bl. Rumphia, iii, 5; Mart. Hist. Nat. Palm. iii, 330; Miquel, Fl. Ind. Bat. iii, 102; Walp. Ann. iii, 480 and v, 829; Becc. Malesia, i, 88 and in Rec. Bot. Surv. Ind. ii, 223.

Calamus niger Willd. Sp. Pl. ii, 203; Pers. Ench. (1805) i, 383; Miq. Palm. Arc. Ind. 29; H. Wendl. in Kerch. Palm., 237.

Palmijuncus niger Rumph. Herb. Amb. v, 101, t. 52.

DESCRIPTION.—Robust. *Leaf-sheaths* strongly gibbous above, densely clothed except at the mouth with weak, spreading, scattered, solitary, elongate, very slender, brittle, blackish spines. *Leaves* terminating in a long clawed cirrrus; petiole robust, as thick as a man's finger, armed on both surfaces with short, straight, ascendent prickles; the rachis equally prickly, and towards the apex furnished with digitate claws underneath; leaflets numerous, rather remotely equidistant, lanceolate-ensiform, 40–50 cm. long, acuminate, their mid-costa and one nerve on each side of it bristly on the upper surface and apparently also on the lower; the margins ciliate. *Fruiting spadix* recurved; the panicle dense, thyrsoid-ovate, on a long and slender, pedicellar, unarmed part. *Fruit* globular or slightly ovoid, reddish-brown when mature. (Description from Rumphius.)

HABITAT.—In the northern part of the Island of Amboina near the River "Guru-Guru". Malayan name "Rotang itam" or "R. Tubu"; in Amboinese dialect "Ua Mette" or "Ua tehu".

The Rotang produced by this species is, according to Rumphius, of very inferior quality, being brittle and difficult to split into regular strips.

OBSERVATIONS.—This species is known only from the description and plate of Rumphius. It seems, however, to be a very distinct species apparently related to *D. macropterus* and *D. lamprolepis*, from which it differs chiefly in its rufous mature fruit, and in the armature of the sheaths. Rumphius describes the leaflets as 15–19 inches long and 4 inches (about 10 cm.) broad, so that the breadth corresponds to about a fourth of the length, though in the plate it is only about $\frac{1}{10}$th; the leaflets therefore should not be more than 3–4 cm. broad. The fruit is said to be a little larger than that of "Rottang Bezaar" (*D. Calapparius*) which is 22 mm. in diam. in Rumph's plate, while that of *D. niger* is, in the plate, 15 mm. only.

37. **DAEMONOROPS LOHERIANUS** Becc. sp. n.

Apparently scandent, and of moderate size. *Sheathed stem* 2·5 cm. in diameter *Leaf-sheaths* obliquely truncate, entire and smooth at the mouth, which is quite devoid of any kind of spines or cilia; armed with irregular oblique series of rather small, blackish, flattened, 5–10 mm. long spiculae. *Leaves* about 1·3 m. long in the pinniferous part, terminating in a long, rather slender, clawed cirrus; petiole about 25 cm. long, 12 mm. broad, 8 mm. thick, strongly biconvex with rather sharp edges, covered on both surfaces and especially near the margins with small, ascendent spines; rachis convex and prickly on the upper surface in its lower portion; towards the apical part the salient angle becomes acute and closely spinulous; underneath the rachis is armed towards the base with solitary very sharp claws, which higher up become at first 3-nate and then 5-nate. *Leaflets* numerous, equidistant, closely set; those of the intermediate portion are 15–20 mm. apart, narrowly lanceolate, opaque and concolorous on both surfaces, 20–23 cm. long, 14–18 mm. broad, narrowing from below the middle to a rather acute base, acuminate to a filiform and laterally bristly tip; on the upper surface the mid-costa and one rather slender nerve on each side of it are rather closely set with bristles; underneath the mid-costa alone carries a few long bristles. *Male spadix* elongate before flowering, very narrow and subterete, about 12 mm. in diam., 45 cm. long and erect; it has a very short densely prickly pedicellar part, about 2 cm. long, furnished with 7–8 primary spathes, each of these rising in gradation out of that immediately below; the outer spathe is rather acutely two-keeled, with tufts of small radiating spiculae on the keels, otherwise it is almost smooth, obliquely truncate at the mouth, which bears a few spiculae and prolonged at the apex into a rather long, prickly, tail-like narrow rostrum; the other spathes terminate also in a more or less prickly slender rostrum, otherwise they are smooth. *Male flowers* in comparison with those of other species are very long and slender, being 8–10 mm. in length and only 1 mm. thick; the calyx is tubular, elongate and cylindrical, shortly 3-dentate; the segments of the corolla are very narrow, striate, acuminate, and almost 3 times as long as the calyx; anthers very narrowly linear.

HABITAT.—Discovered by *Loher* in Luzon at Siya Bundoc, Prov. of Rizal in the Philippines, in June 1905 (No. 7073 in Herb. Kew.).

OBSERVATIONS.—Of this very distinct species I have seen only one specimen, with young male spadices. It is apparently related to the species of the group of *D. lamprolepis;* the outer spathe, however, is as in the species of the group of *D. Hystrix* much shorter than the inner ones, but in the absence of the fruit its exact affinities must remain doubtful. *D. Loherianus* is easily distinguishable by the very strongly biconvex petiole, and especially by the very slender and, relatively, very long male flowers which have a tubular calyx, and by the mouths of the leaf-sheaths being quite smooth, and devoid of any kind of spine, bristle or cilia.

PLATE 41.—Daemonorops Loherianus *Becc.* It represents the type specimen in the Herbarium at Kew.

38. DAEMONOROPS DRACO Blume, Rumphia iii, 8 (partly as to description) pl. 132, and perhaps also pl. 137 C., and excluding pl. 131; Martius, Hist. Nat. Palm. iii, 205, 2nd edit. (partly) and pl. 175, x. f. 1 (fruit) and probably also f. 6, 8 (seed); Miq. Fl. Ind. Bat. iii, 95, and Prodr. Fl. Sum. 78.

Calamus Draco Willd. Sp. Pl. ii, 1, 203; Mart. Hist. Nat. Palm. iii, 211, 1st edit. (excl. f. ix. pl. 116); Roxburgh Fl. Ind. iii, 774 (partly).

C. Rotang δ *Draco* Linn. Sp. Pl. 463.

Palmijuncus Draco Rumph. Herb. Amb. 114, pl. 58 f. A. B.

Drakenbloeds Rottang Valentyn, Beschr. Amb. iii, 218, pl. XLIX.

Rotang Dsjerenang Kaempf. Amoen. Exot. 554.

DESCRIPTION.—Scandent, of moderate size. *Leaf-sheaths* strongly gibbous under the base of the petiole, armed with elongate, needle-like, seriate, erect (deciduous?) spines. *Leaves* have a rather elongate and laterally prickly petiole, and a rachis armed on the upper surface with ascendent straight spinules and clawed underneath. *Leaflets* 30 cm. long, 2 cm. broad, rather numerous, and remotely sub-equidistant, linear-lanceolate, acuminate, ciliate on the margins, and bristly on 3 nerves on both surfaces. *Female spadix* erect or nodding, 60–75 cm. long on the whole; the flowering panicle has 5-6 short partial inflorescences, each carrying a few thick scantily-flowered spikelets; the peduncular part is rather slender, and is more or less armed with short, digitate, divergent spines. *Fruit* very slightly narrower in its upper part than at its base, but not distinctly pyriform.

HABITAT.—The S. E. coast of Sumatra at Palembang (*Rumph*). Referable to *D. Draco* are, I believe, two specimens collected in the Residency of Palembang by Teijsmann, of which one from Muara dua consists of only a spadix with very young fruit (No. 3590 Herb. Hort. Bogor.) and the other from Batu Radja (Herb. Hort. Bogor. No. 3588) which is only a portion of a fruiting spadix, but not one of the fruits is left entire. No other parts of the plant are present.

OBSERVATIONS.—Only the *Palmijuncus Draco* growing at Palembang, described and figured by Rumph (l. c.) can be considered as being the true *D. Draco.* Blume writes that the figure of *Palmijuncus Draco* given by Rumph, which represent the true *D. Draco* (*C. Draco* Willd.) is mediocre and false as to the fruit. I believe, however, that it is fairly good for his time, as there is a small group of Dragon's blood-yielding *Daemonorops* (*D. micracanthus* and *D. Draconcellus*) which have the leaf-sheaths armed with small, seriate, erect, (usually deciduous) spines, and also a slightly conically-ovoid fruit. In Rumph's plate the leaves appear non-cirriferous, only because they were sent to him without their terminal appendage, and the fruit appears not quite full grown. *Daemonorops Draco* of Martius is apparently the true *Calamus Draco* Willd. as to the fruit represented in Plate 175 f. x. 1 of the Hist. Nat. Palm. iii, while it is *D. propinquus* Becc. in respect to the figures x. 3. 5. 6 of the same plate. Further the fruit represented in Plate 116 fig. ix of the Hist. Nat. Palm. iii, as that of *C. Draco* (see the text p. 211, first edit.) is not certainly that of this species.

The description of *D. Draco* as given by Blume is an amalgamation of the characteristics of more than one species, in which are also incorporated those of the true *D. Draco.* I have been able to ascertain this fact by the inspection of a good part of the material examined by Blume himself and kindly forwarded to me by the late Dr. Boerlage. Amongst this material together with some portions of leaves that really do belong to a species of the *D. Draco* group, I have found other portions belonging to the group of *D. melanochaetes.* The leaflets which do really seem to be those of *D. Draco* from Palembang are 37 cm.

long, and 2·5 cm. broad, have on their upper surface a few black bristles on a slender nerve on each side of the mid-costa, and still fewer on this latter; underneath the bristles are rather conspicuous and numerous on 3 nerves, especially from the middle upwards. Those leaflets of which Blume writes "trinervia, nervis supra argute prominentibus, praesertim in facie adversa et marginis instar setulosis, inter hos nervos primarios aliis tenuioribus semipellucidis distincta" correspond to those which I consider to belong either to *D. melanochaetes*, or to *D. palembanicus.* I therefore believe that in Blume's description of *D. Draco* the leaflets are those of one of the above mentioned species, while the description of the leaf-sheaths may very well apply to the leaf-sheaths of *D. ruber*, but not to those of the true *D. Draco.*

Among the fruits considered by Blume as those of *D. Draco* there are in the Leyden Herbarium several from different sources, apparently belonging to more than one species, and presenting noteworthy differences amongst themselves, especially in the shapes of their seeds. Some of these fruits with a seed broader than long seem, to me, to belong to *D. ruber* (*C. ruber* Reinw.); the seed of others much resembles that of *D. Draconcellus,* being flattish on the raphal side, but they may possibly belong to the true *D. Draco* Willd. A fruit of this kind is represented by Martius in plate 175, f. x 1, of which probably the figures x 6, 8 represent the seed, this being oblong, while that of f. x 6, 8 is distinctly conical; this last is, I believe, the seed of *D. propinquus.*

The plate 132 of Rumphia may really represent *D. Draco* Willd.

The canes described by Rumph with internodes 2·5–3 feet long, of which a portion is figured in plate 119 f. D. of the "Herbarium Amboinense" and which is there attributed to *Palmijuncus Draco,* are almost certainly those of *Calamus Scipionum.*

In conclusion, *D. Draco* from Palembang is even yet very imperfectly known, but seems to differ from its very near ally *D. propinquus,* growing especially in the Malay Peninsula, by its leaf-sheaths bearing spiculae, and not laminar spines and by the fruit not being distinctly pyriform, and probably also by some peculiarities in the seed.

The specimens of *D. Draco* collected by Teijsmann in Palembang, which I consider as belonging to the typical form, have the peduncular part of the spadix considerably flattened and spinous only on the margins; the very young fruit of No. 3590 is entirely and very abundantly covered with the characteristic red resin, is ovoid and terminates in an acute conical point. Of the outermost spathe some slashed portions which are still attached to the spathe, are quite devoid of any kind of spines. The portion of the fully developed fruiting spadix of No. 3588, shows the spikelets with a very thick, angular, zig-zag sinuous axis, and a considerable callus at their axillas; they bear distichously 3–5 fruits on each side, but of the fruits only small fragments of the pericarp remain attached to them, so that from these alone it is impossible to recognize the true form of the entire fruit. The seed is wanting. Finally I consider as referable to *D. Draco* a *Daemonorops* collected in Sumatra, in Priaman, by Diepenhorst (No. 3516 Herb. Hort.

Bogor.). Of this I have seen two entire spadices with quite mature fruits; the panicle is 40–45 cm. long, and is borne on a rather slender peduncular part (15–20 cm. long), armed all round with confluent spines; the partial inflorescences (4 in number) are short, and bear a few spreading, very thick, few-flowered spikelets, exactly like those described under *D. propinquus.* The fruit, however, is in no way pyriform, but regularly ovoid, and diminishes equally, but slightly, towards both ends, is obsoletely beaked or mammillate at the apex, very densely covered with red resin, 28 mm. long, 20 mm. broad. The seed is broadly ovoid, 17 mm. long, and 14 mm. broad, slightly flattened, almost equally convex on both surfaces, obtuse at the apex and not lessening from the middle upwards; therefore, in a longitudinal section passing through the raphe it is oblong in outline; the chalazal fovea is central, pit-like, and penetrates to the centre of the albumen; the furrow on the side of the raphe is either very superficial, or almost obsolete; albumen bony, ruminated by narrow and deep black channels. This *Daemonorops* is certainly very closely related to the true *D. Draco* from Palembang, but its fruit is perhaps more regularly ovoid, and the peduncular part is prickly all round, and not only on the margins. From *D. propinquus* it differs still more by the form of the fruit, and especially by the seed, which in *D. propinquus* is conoidal in longitudina section, and has the chalazal fovea rather superficial, and in the shape of a fissure.

39. DAEMONOROPS DRACONCELLUS Becc. Nelle Foreste di Borneo, pp. 324, 590, 608, and in Rec. Bot. Surv. Ind. iii, 224.

DESCRIPTION.—High scandent. *Sheathed stem* about 2 cm. in diameter. *Leaf-sheaths* gibbous above, covered more or less permanently with an adherent tobacco-coloured scurf, armed all over and also at the base of the petiole, except round the mouth, with many interrupted series of small, very fine, blackish, shining, confluent, erect, acicular and subsetiform spiculae, 5–10 mm. long at most; the mouth is obliquely truncate, and hispid on the margin. *Leaves* about 1 m. long in the pinniferous part, terminating in a rather long, slender, finely clawed cirrus; the petiole is elongate, about 50 cm. long, 1 cm. broad, biconvex, and rather strongly flattened, especially at the base, armed all over on its upper surface and on the sides with short ascendent often divergent prickles, much less prickly, or almost smooth, on the under surface; the rachis, in its basal portion, is convex above with a narrow groove on each side for the insertion of the leaflets, it is bifaced, and with an acute spinous salient angle higher up; underneath it is armed with claws, solitary just above the base, 3-nate towards the upper end, 5-nate and half-whorled on the cirrus. *Leaflets* numerous, equidistant, about 2 cm. apart, linear, very narrow, 20–30 cm. long, 7-10 mm. broad, very gradually acuminate to a subulate and bristly tip, thinly but rather firmly papyraceous, green and almost glossy on both surfaces; on the upper they are unicostate and smooth; on the lower the mid-costa is very closely and minutely ciliate and usually a slender nerve on each side of the mid-costa bears small appressed bristles as well; transverse veinlets slender but distinct; margins very minutely, remotely, and appressedly spinulous. The *male* and *female spadices* are very much alike, and are borne on a slender, flattened, 8–10 cm. long peduncular part, which gradually broadens into the outermost spathe, and is armed, at least on the edges, with rigid, rather robust, deflexed, often confluent, yet divergent prickles; the spathes are all thickly coriaceous, open and more or less flat during the anthesis, or else the margins become revolute; they are narrowly lanceolate, rather obtuse, or else very slightly split or bidentate at the apex, covered externally with a very thin adherent rusty-brown indumetum, glabrous and finely striate inside; the outermost spathe is two-keeled at its base only, and is sparingly prickly on the keels, the others are unarmed. *Male spadix* more elongate than the female and narrow before flowering; its outermost spathe is 20–25 cm. long and 2·5–3 cm. broad; the flowering panicle is 50 cm. long (in one specimen), is narrow, strict and has 6–7 partial inflorescences, covered in every part with an abundant rusty-furfuraceous scurf; partial inflorescenes strict, cupressiform, 10–12 cm. long, divided into many branchlets, each 4–5 cm. long and carrying subdistichously 4–6 spikelets on each side; the spikelets are small and very few-flowered, 1 cm. long, and with 4–5 unilaterally-set flowers at most; the axis of the spikelets angular and with a notch at the insertion of each flower; spathels very small, bracteiform, ciliate; involucre indistinct. *Male flowers* linear-oblong, obtuse, obsoletely trigonous and often asymmetric from mutual pressure; the calyx cupular-obconical with 3 rather elongate and subulate teeth, finely striately veined; the corolla two and-a-half times as long as the calyx, also finely striately veined. *Female spadix* shorter than the male, and covered in every part with an adherent thin ferruginous indumentum; the flowering panicle 25–30 cm. long with 4–5 partial infloresences, the lowest being the largest; the latter is 8–10 cm. long, and has 6–7 spikelets, is erect during the anthesis, but spreading in the fruiting stage, at which time it has a distinct axillary callus; the other partial inflorescences are shorter, and have fewer spikelets; the terminal is reduced to a single few-flowered spikelet; the main axis of the spadix is rigid, and has slender, obsoletely angular internodes; secondary spathes very small, scale-like; spikelets 4–6 cm. long, having 8–12 flowers in all, erect when bearing flowers, horizontal, almost deflexed in the fruiting stage and having a very distinct swollen callus at their axilla, their axis rather thick and acutely angular; spathels annular, very short, extended at one side into a triangular, acute or acuminate point; involucrophorum pedicelliform, 3–5 mm. long, rather thick, trigonous, and slightly clavate, at first erect, horizontal or even slightly deflexed and with a distinct and swollen callus at its axilla when bearing fruit, slightly produced at one side into a very short and broad limb; involucre thick, shortly obconic, raised about 2 mm. above the involucrophorum, terminated by a flat surface, bordered by a very narrow membraneous 3-denticulate rim; areola of the neuter flower lateral, flattish, with a small basilar punctiform swollen scar. *Female flowers* subpyramidate-trigonous and acute before the anthesis, 7–8 mm. long; the calyx cupular, about as long as the tubular part of the corolla, with 3 very broad acute teeth, and finely striately veined; the corolla is two and-a-half times as long as the calyx, its segments elongate-triangular, acute, slightly longer than the stigmas; the latter are trigonous-subulate. *Neuter flowers* very similar to the male, but more slender. *Fruiting perianth* explanate, but the calyx has a short callous base. *Fruit* globose-ovoid, slightly conical in its upper part or at times ovoid-ellipsoidal, crowned by the small recurved sessile stigmas, 2 cm. in diam; scales incrusted with an abundant, blood-red, resinous secretion, otherwise of a uniform straw-yellow colour, convex, narrowly and deeply grooved along the centre, regularly rhomboidal, quite blunt at the apex, 5 mm. broad. *Seed* oblong, 12–13 mm. long, 8 mm. thick, 11 mm. broad, somewhat laterally flattened (non-depressed), deeply pitted; chalazal fovea fissuriform and almost central; embryo basal.

HABITAT.—Borneo. Collected by myself in July 1867 on Buket Skadjang, at the foot of Gunong Mattang near Kuching, in Sarawak. (P. B. No. 3644.) It yields the best quality of Dragon's blood known in Sarawak.

OBSERVATIONS.—It is related to *D. Draco* and *D. micracanthus* in respect of the leaf-sheaths, which are armed with bristle-like seriate spiculae, not with laminar spines, but differs from both, as from the other allied species, by the very narrowly linear leaflets.

From what I can judge by the specimen of a leaf (Herb. Hort. Bog. No. 16337) *D. Draconcellus* grows also in Dutch Borneo probably in the Residency of Sambas, but the exact locality is not noted. In this leaf the leaflets are exactly as in the specimens from Sarawak, but they are minutely ciliate only on the mid-costa and underneath, while the side nerves are usually naked, and only exceptionally have a very few bristles upon them.

PLATE 42.—Daemonorops Draconcellus *Becc.* Portion of the sheathed stem with a male spadix on the right hand side of the plate); female spadix in flower (in the centre). Fruiting spadix of the typical form; 3 detached fruits of a variety which has the fruit ovoid ellipsoidal; detached male and female flowers (in the upper part of plate).

40. DAEMONOROPS MICRACANTHUS Becc. in Hook. f. Fl. Brit. Ind. vi, 467, and in Rec. Bot. Surv. Ind. ii, 224 (*micracanthus*); Ridl. Mat. Fl. Mal. Pen. ii, 180.

Calamus micracanthus Griff. in Calc. Journ. Nat. Hist. v, 62, and Palms Brit. Ind. 72; Mart. Hist. Nat. Palm. iii, 339; Walp. Ann. iii, 489, and v, 831 (*micracanthus*); Miq. Fl. Ind. Bat. iii, 128.

DESCRIPTION.—Scandent, slender. *Sheathed stem* 10–13 cm. in diam. *Leaf-sheaths,* elongate, cylindrical, gibbous above, covered with very numerous, minute, light-coloured, spinuliferous tubercules, which are at times scattered but more frequently confluent, and aligned to form very small, unequal, sinuous, interrupted and more or less approximate series. *Ocrea* very short or almost obsolete. *Leaves* on the lower part of the stem of very young plants not cirriferous; the upper leaves have a slender (in one leaf 40 cm. long) clawed cirrus; petiole slender, elongate 20–30 cm. long, channelled only at its base, otherwise flattish above or else sub-biconvex, margins acute and more or less prickly, beneath feebly armed along the centre with a few solitary, small claws; rachis bifaced, with a very acute salient but smooth angle on the upper surface, sparingly and feebly clawed underneath or at times, in non-cirriferous leaves, smooth; leaflets rather numerous (14–20 on each side), rather remotely equidistant, inserted at a rather acute angle, narrowly lanceolate or linear-lanceolate, larger about their middle and gradually narrowing thence towards a rather acute base, and upwards to a very gradually long-acuminate, and bristly-penicillate tip; they have 3 bristly-spinulous costae on both surfaces; underneath the spinules of the mid-costa are very small and very approximate; transverse veinlets sinuous and slender; the margins appressedly spinulous-serrulate; the intermediate leaflets are about 30 cm. long and 15 mm. broad; the upper leaflets are shorter and less acuminate. Other parts unknown.

HABITAT.—The Malayan Peninsula at Malacca (*Griffith*). Malayan name "Rotang Djernang". Rediscovered in 1900 by *H. N. Ridley* at Panchur, Johore River (No. 10952 in Herb. Calcutt.). Malayan name "Rotang Tahi Ayam" or "R. Djernang". Also at Kwala Pilak in Negri Sembilan on Bukit Senaling (*S. Moorhouse*). Ridley gives also the locality of Bukit Timah in Singapore.

OBSERVATIONS.—I have seen some portions of Griffith's type specimens in the Herbaria of Kew, Calcutta and Brussels (Herb. Mart.). The Kew specimen is of a non-cirriferous leaf; that of Brussels has a leaf with a cirrus 40 cm. long; that of Calcutta forms the passage between the two having only a rudimentary cirrus. Ridley's specimens seen by me agree perfectly well with those of Griffith and are also sterile; their leaf-sheaths still bear a few small spiculae, which rest on the permanent tuberculiform base; these sheaths apparently have their surfaces marbled or spotted, a fact which accounts for the Malay name "R. Tahi Ayam", viz., the "Fowl-dung Rotang", the variegation having that appearance. The vernacular name of "Rotang Djernang" would indicate that it is one from which the Dragon's blood (=Djernang) is extracted. And indeed *D. micracanthus* much resembles *D. Draconcellus*, one of the species that yields the best quality of that drug in Sarawak, and from which it differs only in its broader linear-lanceolate leaflets with 3 bristly nerves on both surfaces. It seems also a very near ally of the true *D. Draco* (*Palmijuncus Draco* Rumph.) from which apparently it differs in the more slender stems and in the sheaths not carrying true spines, but very minute, seriate, deciduous spiculae, resting on a bulbous base.

Ridley (l. c.) describes the spadix of *D. micracanthus:* "Short, under 6 inches, "peduncle 3 inches or more long, the lower half armed with short conic black-"tipped spines with a thickened base; branches of spadix short, thick, angular. "Spathes linear-oblong, outer one armed with transverse crests of flat spines ¼ inch "long, gray. Bracts (spathels? Becc.) very small, ovate, obtuse. Calyx: saucer shaped, "nearly flat (in the fruiting perianth? Becc.) with very short rounded lobes. Petals "lanceolate, ribbed, about 4 times as long. Fruit oblong-globose, ¾ inch through, "shortly beaked; (scales) rhomboid, rather broader than long, brownish yellow, "grooved down the centre, very strongly resinous. Seed suborbicular flattened; albumen "much pitted."

PLATE 43.—Daemonorops micracanthus *Becc.* Figs. 1–3, from the type specimen in the Herbarium at Kew; f. 4 from a similar specimen in Martius's Herbarium at Brussels.

41. DAEMONOROPS PROPINQUUS Becc. in Hook f. Fl. Brit. Ind. vi, 467, and in Rec. Bot. Surv. Ind. ii, 224; Ridley, Mat. Fl. Mal. Pen. ii, 181.

Calamus Draco (not of Willd.) Griff. in Calc. Journ. Nat. Hist. v, 65, and Palms Brit. Ind. 75 (exl. descript. of Roxb. ?) pl. CCI, A. B.; Mart. Hist. Nat. Palm. iii, 205, 2nd edit. (partly), pl. 175, f. x 3, 4, 5, 7 (excl. f. 1 and perhaps f. 6, 8, which apparently belong to *D. Draco* from Palembang).

DESCRIPTION.—Scandent, and of moderate size. *Sheathed stem* about 3 cm. in diam. *Leaf-sheaths* gibbous above, densely armed with very unequal spines, of which some are robust, elastic, laminar and rise from a broad base, sub-lanceolate, subulate, brown with lighter tip, often laciniate, more or less deflexed, and usually solitary; other smaller but far more numerous spines are interposed between the former and are usually scattered all over the surface, but at times are subseriate and cover the base of the petiole as well; the spines near the mouths of the leaf-sheaths are not larger than the others. *Leaves* rather large, cirriferous; the petiole on its upper surface is covered with short ascendent spines; the rachis is underneath roundish and armed along the centre of the dorsum with claws that are at first solitary, then 3-nate, half-whorled at regular intervals towards the apex and still more so on the cirrus; on the upper surface the rachis is bifaced with a salient angle, which is at first obtuse and sparsely prickly, but very acute and smooth towards the upper end; leaflets rather numerous, alternate or subopposite, rather remote (4–6 cm. apart), equidistant, firmly papyraceous, glabrous, green, very slightly glossy on both surfaces, narrowly lanceolate or lanceolate-ensiform, broadest near or below the middle, long-acuminate to a subulate tip and rather gradually diminishing towards the base; the mid-costa has a few short bristles on the upper surface, but only near the apex; the secondary nerves are slender, and one on each side of the mid-costa is also sparingly bristly; underneath the mid-costa alone has a few long bristles; the transverse veinlets are very numerous, excessively minute, and give a faintly grained appearance to both surfaces when observed under a lens; margins remotely (closer towards the apex) spinulous; the intermediate—the largest—leaflets are 40–42 cm. long, 25–30 mm. broad; the upper are shorter, narrower, and, as usual, more remotely set. *Male spadix* . . . *Female spadix* nodding, sub-axillary, panicled; the panicle is diffusedly ovoid, 40–60 cm. in length, with 6–7 partial inflorescences and a pedicellar part which is 7–10 cm. long, is slightly flattened, and has rather acute edges that are strongly armed with straight, thick, woody, rigid, deflexed palmate-digitate spines, arising from a very thick base and with the central spine of each group longer than the others; primary spathels very thickly coriaceous, or almost woody, of a cinnamon-brown colour, glabrous, and rather glossy inside, finely rusty-furfuraceous externally, deciduous after flowering; the outermost apparently persists longer than the others, and is armed all over, but especially along two faint dorsal carinæ with the same kind of spines as those which cover the peduncular part, but more slender, and often aligned into transverse horizontal series; the second and third spathes bear only a few, solitary, or 3-nate-digitate spines along the centre of the dorsum; the other spathels are smooth, and all in the unexpanded spadix protrude gradually one above the other; the main axis is obsoletely angular in its lower part, slightly flattened higher up, and bears the impressions left by the branches and spikelets during prefloration; the internodes are 6–8 cm. long; the lowest (largest) partial inflorescences have a short peduncular part (1–2 cm. long), are 12–16 cm. in length, and have 3–5 spikelets on each side; the upper inflorescences are gradually shorter, and have fewer spikelets; all have a distinct axillary callus; their axes are rather thick and sub-trigonous; the secondary spathes are reduced to a very short, annular, entire limb, slightly prolonged at one side into a short, acute point. *Spikelets* covered with an adherent, thin, rusty-furfuraceous indumentum, bifariously inserted, but somewhat turned outwards, the lowest—the largest—are 4–6 cm. long and carry 5–9 alternately distichous and subsecund flowers in all; upper spikelets shorter and with fewer flowers; the axes of the spikelets are sinuous, thick and acutely trigonous; spathels resemble the secondary spathes, but are smaller; involucrophorum pedicelliform, 3–5 mm. long, thick, slightly obconical, trigonous, more or less callous at its axilla, truncate and flat above, and with a very narrow limb, that is slightly extended at one side into a small triangular point; the involucre is slightly raised above the involucrophorum, is shortly and thickly pedicelliform, flat-discoid, orbicular, 5 mm. in diameter at its upper end, edged by a short limb, which is slightly produced on the outer side; areola of the neuter flower very conspicuous, usually longer than broad, slightly concave and sharply edged. *Fruiting perianth* explanate. *Fruit* conspicuously stalked by the pedicelliform involucre, rather large, 23–25 mm. long, about 20 mm. across in its broadest part (a little above the base), ovoid-pyriform, *i.e.* rather conspicuously diminishing from near the base towards a somewhat broad, and slightly depressed apex; the latter crowned by the remains of the small, sessile, divergent, thickish, and linear stigmas; pericarp brittle; scales arranged in 16–18 longitudinal series, regularly rhomboidal, broader than long (6×4 mm.) sharply and narrowly grooved along the centre, abundantly covered with dragon's blood secretion, and glossy when covered with it, otherwise dull and uniformly yellowish-brown, very slightly prolonged into a short, round point, their margins faintly erosely-toothed. *Seed*, when divested of the dry, crustaceous, brittle (once fleshy) integument, broadly-conically-ovoid from a flattish base, 15 mm. long, 12–13 mm. broad, slightly ventricose on the raphal side; the chalazal fovea is placed a little below the middle, is slit-like and does not penetrate very deeply into the albumen; the surface is very finely pitted, and minutely grained; albumen deeply ruminated; embryo exactly basal. Sometimes two seeds are to be met with in one fruit, and then they are flat on one side and convex on the other.

HABITAT.—Pulo Penang (*Griffith*) where, as far as I know, it has not been found again by modern botanists. In the Malayan Peninsula in the district of Perak (*Scortechini* in Herb. Beccari). Also in Sumatra (*Forbes* No. 2287 in Herb. Calcutt.). This is the best dragon's blood-yielding Rotang in the Malayan Peninsula. Malay name "Rotang Djernang".

OBSERVATIONS.—It is very closely related to *D. Draco*, growing in Palembang, from which it differs by its fruit being more plainly pyriform, and by the conically shaped seed; it probably also differs in the leaf-sheaths which are, apparently, covered with small spiculae in the Palembang plant, and conspicuously armed with laminar spines in *D. propinquus*.

My description of *D. propinquus* is derived from many sources. I have examined in the Herbarium at Kew a portion of the fruit spadix figured by Griffith in the plate CCI, B. (*Calamus Draco*) and another specimen of a very young spadix, apparently that figured in plate CCI, A. Identical with Griffith's specimens is one of Scortechini's accompanied by a portion of a leaf; on this material I have based the description of the leaves and fruit; the characteristics of the leaf-sheaths are derived from Forbes's No. 2287; in this specimen the spadix, in flower, is 35 cm. long, and the leaflets are 27 cm. long, and 22-23 mm. broad, or somewhat smaller than in Scortechini's type specimens. The fruit figured by Martius as that of *Calamus Draco* in plate 175, f. x 3, 4, 5, 7 and said to come from

Penang is certainly that of *D. propinquus;* probably it belonged to the same fruit-spadix figured by Griffith in plate CCI, B; its seed (fig. 5, 7) has the characteristic conical-ovoid form peculiar to *D. propinquus*, whereas the seed represented by the figures 6 and 8 of the same plate, which is oblong in section is apparently that of *D. Draco* from Palembang.

PLATE 44.—Daemonorops propinquus *Becc.* An intermediate portion of a leaf and a fruiting spadix; seed entire, from the raphal and antiraphal side; another seed longitudinally cut through the chalazal fovea and the embryo. From Scortechini's specimen in Herb. Beccari.

PLATE 45.—Daemonorops propinquus *Becc.* Portion of the sheathed stem with two female spadices shortly after the flowering stage; the upper end of a leaf. From Forbes' No. 2287 in Herb. Beccari.

42. **DAEMONOROPS RUBER** Bl. Rumphia, iii, 6 (partly as to description), pl. 148 f. 8–12; Mart. Hist. Nat. Palm. iii, 205, 2nd edit. ♂ (only as to the plant of Reinwardt ♂); Walp. Ann. iii, 478, and v, 828; Miq. Fl. Ind. Bat. iii, 95; Teijsm. Cat. Hort. Bogor. 74.

Calamus ruber Reinwardt in Mart. Hist. Nat. Palm. iii, 209, 1st edit., pl. 116 f. 5, fruit; Kunth, Enum. Pl. iii, 208; Miquel, Analecta Bot. Ind. 6, and De Palm. Arc. Ind. 29.

Daemonorops accedens Bl. Rumphia iii, 13 (excl. var. *brevispatha*, pl. 133; Walp. Ann. iii, 478 and v, 828; Miq. Fl. Ind. Bat., iii, 94, and Prodr. Fl. Sum. 256 and 593(?); Teijsm. Cat. Hort. Bogor. 74.

Calamus accedens Miq. De. Palm. Arc. Ind., 28; H. Wendl. in Kerch. Palm. 235.

Palmijuncus Draco (only as to the fruits from Java) Rumph. Herb. Amb. v, 116.

DESCRIPTION.—Scandent, rather robust. *Sheathed stem* 2·5–4 cm. in diam. *Leaf-sheaths* fugaciously rusty-brown furfuraceous, powerfully armed with lead-brown, flat, very unequal, horizontal or slightly deflexed spines, of which some are large and as much as 5 cm. in length, slightly wavy or sinuous, approximate by their broad bases, and more or less irregularly seriate, while others, more numerous and a good deal smaller, are interposed between the large ones, and are either scattered, or more or less seriate. *Leaves* large, about 2 m. long including the petiole, and prolonged (those at least on the upper part of the stem) into a long and clawed cirrus; the petiole in the leaves of the upper part of the adult plant is 12–13 mm. broad and about 30 cm. long, while in leaves of young plants and in those of the lower part of adult plants is twice as long ♂; it is plano-convex just at its base, otherwise flattened-biconvex, armed on the upper surface and on the margins with straight prickles, those on the margins being the longest, on the lower armed along the centre from end to end with straight, strong, at times deflexed, 3-nate prickles, which change into claws on the rachis; the latter convex in its first portion on the upper surface, where more or less armed with scattered prickles and with a narrow groove on each side, in which the leaflets are inserted; higher up the rachis is bifaced on its upper surface with a very acute and smooth salient angle, while the under surface is armed with half-whorls of claws, which are united in the cirrus in groups of five to seven, or even to as many as nine. Leaflets rather numerous (40–50 in all) alternate or sub-opposite, rather remote (5–8 cm. apart), sub-equidistant, firmly papyraceous, glabrous, green and faintly glossy on both surfaces, narrowly lanceolate or lanceolate-ensiform, broadest about or below the middle, long-acuminate to a subulate tip and narrowing slightly and gradually towards the base; the mid-costa has on the upper surface a few short bristles near the apex only, the side nerves are slender and one of these on each side is also bristly; underneath the mid-costa alone carries a very few short bristles, or is at times quite bare; the transverse veinlets are excessively minute, numerous, short, and have an obsoletely-grained appearance on both surfaces when seen under a lens; margins minutely, appressedly and remotely spinulous but less remotely so near the apex; the intermediate (largest) leaflets are 30–45 cm. long, 3–3·5 cm. broad; the upper are smaller and more distant. *Male* and *female spadices* very similar before flowering, elongate (40–65 cm. long), cylindraceous, about as thick as a man's finger, nodding, and with a short, flattened, two-edged, smooth or prickly pedicellar part; primary spathes imbricate; the outermost is the shortest, and each following spathe rises considerably above that immediately below it, all thickly coriaceous, almost woody, cinnamon-brown and glabrous internally, finely rusty-furfuraceous externally at least on the covered parts; the outermost, which is long persistent, when expanded is slightly concave, oblong-spathulate, 4–5 cm. wide in its broadest part or above the middle, and diminishes gradually towards the base, the upper end diminishing to a broadly triangular, but not very acute, and often bidentate point; the outer surface is acutely two-keeled but only near the base, and is powerfully armed with strong digitate or shortly seriate, flat, unequal, horizontal, light-coloured spines; the inner spathes, which are at first cylindraceous, are after the anthesis flat with revolute margins; the inner spathes are thinner in texture, narrower and somewhat longer than the outer one and have a single line of digitate spines along the centre of the dorsum in their exposed upper portions. *Male spadix*, when in flower, strict, very narrowly cupressiform with 6–7 partial inflorescences; the main axis is subterete, slender as pack-thread, slightly sinuous; secondary spathes inconspicuous, reduced to a very small and short infundibuliform limb, slightly produced at one side into a triangular point; partial inflorescences 6–7 cm. apart, 8–10 cm. long, borne on a short, slender, pedicellar part; they are erect, strict, cupressiform, divided into several slightly furfuraceous branchlets carrying each 7–8 small spikelets; of the latter the lowest—the largest—are about 2 cm. long with 7–8 not quite regularly set, almost unilateral flowers; the axis of the spikelets is very slender, filiform, slightly furfuraceous and superficially notched at the insertion of the flowers; spathels bracteiform, scarious, very small, short, broad and obtuse; involucres reduced to inconspicuous scales round the base of the flowers. *Male flowers* narrow, linear, bluntish, obsoletely angular, slightly sinuous and asymmetric, 5–6 mm. long; the calyx very short, cyathiform, obconical, with 3 acute teeth; the corolla 4–5 times as long as the calyx. *Female spadix* elongate with 7–8 partial inflorescences that are 10–15 cm. long (strict and cupressiform during the anthesis), borne on a short peduncular part and carrying several spikelets, covered in every part with a fine rusty-furfuraceous, not very adherent and partially fugacious scurf; the internodes of the main axis are 6–7 cm. long, thicker than in the male spadix, cylindraceous, with several small depressions and swellings produced during prefloration; the largest (lowest) spikelets of each inflorescence, are 6–8 cm. long and have 4–6 not quite distichous flowers on each side; their axes are somwhat thick, acutely angular, sinuous; spathels very short, annular, scarious, slightly extended at one side into a short, broadly triangular, acute limb; involucrophorum pedicelliform, obconical, rather slender at the base, acutely angular, not callous at the axilla, extended on one side at the upper end into a broadly triangular acute point; involucre slightly raised above the involucrophorum and terminating in a broad, flat, orbicular scar which is edged by a short, annular, truncate, obsoletely 2-toothed rim; areola of the neuter flower concave, niche-like, and not swollen round the scar. *Female flowers* conically elongate, acuminate before opening, 8 mm. long, 4 mm. thick; calyx short, cupular, striately veined, rusty-furfuraceous at the base and having 3 superficial apiculate teeth on the margin; corolla thrice as long as the calyx, its undivided urceolate basal part as long as the calyx, the segments triangular-lanceolate, often slightly sinuous; stigmas reach the apex of the segments during the anthesis. *Neuter flowers* usually flattened by pressure, lanceolate in outline, acute, about 6 mm. long, their calyx obconic-cyathiform, 3-denticulate; their corolla thrice as long as the calyx. *Fruiting perianth* explanate. *Fruit* rather large, spherical, or at times slightly depressed, perfectly round above with a very short beak; scales exactly rhomboidal, not prolonged at the apex, arranged in 18 longitudinal series very narrowly and sharply grooved along the centre, of a uniform straw-brown colour, covered by a thin coating of red resin. *Seed* globular.

HABITAT.—It is only certainly known to grow in West Java in the province of Bantam. Javanese name "Hooy Pella"; Malay name "Rotang Pellah". Blume gives it also that of "Hooy Selan" of the hill people of Java; but this name is more particularly applied to *D. melanochaetes.*

OBSERVATIONS.—This species was first named *Calamus ruber* by Reinwardt in a letter addressed by him to Martius, and accompanied by a drawing of the fruit, which is reproduced in plate 116 f. V, of the "Historia Naturalis Palmarum"; the description appeared at page 209 of the first edition of the pages 179–230 of that work. In the second edition of these pages, *C. ruber* appeared under the name of *Daemonorops ruber* at page 205, but here Martius excludes the figure (V) of the fruit, upon which, however, the species *D. ruber* must, I believe, be based. Martius nevertheless is right in considering this fruit as being that of *D. accedens* Bl., but this is one and the same with *D. ruber* of the same author. Martius's description of *D. ruber* at page 205 does not therefore apply at all to *Calamus ruber* of Reinwardt, but corresponds in part to the *Daemonorops* figured by Blume under the name of *D. Draco,* and in part to *D. propinquus.*

Of *D. accedens* Bl. I have seen portions of Blume's authentic specimens collected in Java by Kuhl and Van Hasselt, which correspond exactly to Blume's description and figure mentioned above. Further I received from Dr. Treub complete specimens of *D. ruber,* cultivated at Buitenzorg, upon which I have principally based my description, and which have enabled me to establish the absolute identity of *C. ruber* Reinwardt (*D. ruber* Bl.) with *D. accedens* Bl.

Blume (Rumphia l. c.) describes the outer spathe of *D. ruber* "aculeis crebris setiformibus echinata", probably because parts of other species had been mixed with the specimens studied by him, as all the species of the group of *D. Draco*, to which *D. ruber* belongs, have the outer spathe armed with short stout, digitate spines, while bristly spines on the spathes occur in species belonging to quite different groups. This circumstance may perhaps account for Blume not having recognized *C. ruber* Reinwardt in his own *D. accedens.*

The red secretion of the fruit of *D. ruber* is very scanty and not worth collection.

PLATE 46.—Daemonorops ruber *Bl.* Portion of a leaf-sheath with the petiole; an intermediate portion of a leaf (under surface); male spadix (in the centre of the plate); female spadix in flower and the apex of a spadix with a mature fruit (on the left side). From a specimen cultivated at Buitenzorg in Herb. Beccari.

43. DAEMONOROPS MATTANENSIS Becc. Nelle Foreste di Borneo, 608, and in Rec. Bot. Surv. Ind. ii, 224.

DESCRIPTION.—Scandent, of moderate size. *Sheathed stem* about 2 cm. in diam. *Leaf-sheaths* very slightly gibbous above, rusty-furfuraceous, not very densely armed with solitary, scattered, very unequal, short or long, flat, brown-schistaceous spines; the mouth sparingly spinous or at times smooth. *Leaves* about 1·2 m. long in the pinniferous part and terminating in a rather slender cirrus; the petiole itself 30 cm. long (in one leaf), thickly biconvex, 8–10 mm. broad, with obtuse edges, armed beneath along the dorsum with rather feeble, straight, deflexed spines, and covered on the upper surface with numerous very small, very sharp, ascendent prickles which rest on a tuberculiform base; the prickles longer near the base, especially on the margins; the rachis is convex on its upper surface and prickly in its lower portion and has a superficial furrow on each side where the leaflets are inserted; higher up it is bifaced and has the salient angle spinulous; on the lower surface it is armed along the dorsum with solitary, not very strong claws, which become first 3-nate, and finally 5-nate—half-whorled, but towards the apex only and on the cirrus; leaflets not very numerous (36 in all in one specimen), sub-equidistant, remote (5–10 cm. apart), papyraceous, green, slightly paler beneath, ensiform, gradually narrowing towards a rather acute base, and not very gradually and rather shortly acuminate at the upper end to a subulate ciliate-spinulous tip; the mid-costa is acute and the side nerves slender and naked on both surfaces; the mid-costa alone has a few spinules on the upper surface near the apex; transverse veinlets very numerous, very minute and short, and under a lens give an almost granulate appearence to the upper surface; margins very minutely, appressedly and rather closely spinulous; the largest leaflets are the intermediate, 25–30 cm. long, 18–22 mm. broad. *Male spadix* . . . . *Female spadix* nodding, borne on a slender, almost unarmed, flattened, obtusely edged, 15–18 cm. long, peduncular part. Primary spathes . . . . . The flowering panicle itself is short, 16–18 cm. long, is covered in every part with a rusty-furfuraceous indumentum and carries a few (4–5) approximate, small, partial inflorescences, of which only the lower have 5–6 small spikelets in all and the upper only 1–3; the secondary spathes have a very short annular limb, slightly extended at one side into a short, broadly triangular point; spikelets short, the largest 2·5–3 cm. long and with only 4–5 flowers in all; their axes are thickish, strongly sinuous, acutely 3-gonous; the spathels have a short annular limb extended at one side into a very broad, yet short, acute point; involucrophorum short and thick, obconic, more or less angular, extended at the upper end on one side into a triangular acute point; involucre slightly raised above the involucrophorum by a thick base, very shallowly cupular or with the broad, flat, orbicular floral disc bordered by a short, annular, truncate limb; areola of the neuter flower slightly concave, niche-like, the scar indistinct. *Female flowers* conic, acute, with a flat base, 6–7 mm. long; the calyx very short, subcupular, truncate, with 3 very superficial apiculate lobes, rusty-furfuraceous, not or obsoletely veined; the corolla thrice as long as the calyx, parted almost to the base into 3 triangular acuminate segments. *Fruiting-perianth* quite explanate. *Fruit* broadly ovoid, or sub-pyriform, with a rounded base and a regularly conical and rather acute top; it is 23–24 mm. long, 19–20 mm. broad, crowned by the small recurved stigmas; scales in 15 longitudinal series, regularly rhomboid, not produced at the point, broader than long, narrowly and sharply grooved along the centre, yellowish or umber-brown, tinged red very slightly with a scanty resinous secretion. *Seed* globular-ovoid, slightly conical at its obtuse upper end, conspicuously gibbous on the raphal side, 16 mm. long, 13–14 mm. broad, 12–13 mm. thick; embryo basal.

HABITAT.—Borneo, on Mount Mattang near Kuching in Sarawak, *Beccari* P. B. No. 1931.

OBSERVATIONS.—This species is related to *D. didymophyllus* and *D. Motleyi*, but it has equidistant not geminate leaflets. My specimens want the primary spathes, which are all very soon deciduous, but apparently must be short and similar to those of the two species mentioned. The Dragon's blood secretion on the fruits is very scanty.

PLATE 47.—Daemonorops mattanensis *Becc.* An intermediate portion of a leaf (under-surface); portion of a sheathed stem; one spadix with young, and another with full-grown fruits. From P. B. No. 1931 in Herb. Beccari.

44. DAEMONOROPS GRACILIPES Becc. in Rec. Bot. Surv. Ind. ii, 225.

Calamus (sect. *Daemonorops*) *gracilipes* Miq. de Palm. Arc. Ind. 28; H. Wendl. in Kerch. Les Palm. 236.

Daemonorops accedens var. *a brevispatha* Bl. Rumphia, iii, 13, pl. 133 C; Miq. in Journ. de Bot. Néerl. i, 19 and Fl. Ind. Bat. iii, 94.

Daemonorops longipes (not of Mart.) Miq. Prodr. Fl. Sum., 255 and 592 (1860), and in Journ. de Bot. Néerl. i, 18.

DESCRIPTION.—Not scandent, erect, 1·5–2 m. high. *Sheathed stem* in its upper part 15–18 mm. in diam., and 3 cm. at the base, where it is covered by the bases of the radical leaves; naked canes 8–10 mm. in diam. *Leaf-sheaths* covered with a rusty-brown furfuraceous scurf, deeply striate longitudinally, the lower ones amplectent, split and open on the ventral side and with short stipuliform appendages at their mouths; those of the upper part of the plant, tubular-cylindrical, not or only very slightly gibbous above, more or less obliquely truncate unarmed and non-ocreate at the mouth, sparingly armed with scattered or subseriate lead-brown, flat, 1–2 cm. long, spreading or deflexed spines; the radical or lowest leaves have a few sub-radiate-digitate leaflets borne on, at times a very long (80 cm.), subterete or obsoletely angular and superficially grooved petiole; the intermediate leaves are pinnate but non-cirriferous, 1–1·2 m. long in the pinniferous part, with a petiole as much as 1 m. in length and sparingly prickly; the leaflets are numerous, subequidistant, 5–7 cm. apart; only the leaves of the upper spadicigerous part of the plant terminate in a slender clawed cirrus; in the upper leaves the leaflets are more distinctly inequidistant and often in pairs on each side of the rachis; the petiole is 30–40 cm. long, somewhat flattened, plano-convex at the base, otherwise biconvex with acute edges, armed with straight, elongate, spreading spines on the edges, especially near the base, beneath smooth, or with only a few straight deflexed prickles along the centre of the dorsum; rachis armed beneath as usual with small solitary claws which become ternate near the upper end and 5-nate–half-whorled on the cirrus; on the upper surface the rachis obtusely convex at first and bifaced from the middle upwards with a very acute, salient non-prickly angle; leaflets ensiform, broadest a little below the middle, and thence gradually narrowing towards the base, and gradually acuminate to a rather fine bristly tip, thinly papyraceous, green on both surfaces, with the mid-costa acute on the upper and bristly-spinulous but only near the apex or else quite smooth; beneath it is more or less bristly from the middle upwards; the secondary nerves are all slender but sharp, bold on both surfaces, yet sometimes one on each side of the mid-costa, though not stronger than the others, is very sparingly spinulous on the upper surface; transverse veinlets excessively numerous and minute, giving under a lens a faintly granular appearance to the upper surface; margins very minutely, remotely and appressedly spinulous; the lower margin on the upper surface is often distinctly edged by a very narrow glossy band; the largest leaflets of the intermediate leaves are 40–50 cm. long, and 2·5–3 cm. broad, and are less acuminate than those of the terminal leaves which are also smaller (35–40 cm. long and 2 cm. broad). *Spadices male* and *female*, before flowering almost similar, cylindraceous–fusiform, as thick as the little finger, erect, nodding, or at times recurved, borne on a pedicellar part which varies from 3 to 12 cm. in length and is slender, flattened and smooth, or has edges armed with solitary straight spines; spathes thickly coriaceous, finely rusty-furfuraceous externally, glabrous inside; the inner spathes slightly longer than the outermost, and all very soon deciduous; the outermost are, before flowering, split on the ventral side and cornet-shaped, then open, more or less completely flat, or with margins revolute, 10–15 cm. long, oblanceolate or elliptical-lanceolate, shortly and not very acuminate at the apex, feebly armed externally with two lines of small, ascendent spines. *Female spadix* has a rather short panicle, usually 15–20 cm. or at most 30 cm. long, covered in every part with a more or less persistent, thin, rusty-furfuraceous indumentum; its main axis is rather slender, slightly but unevenly flattened; the internodes are 3–5 cm. long; partial inflorescences 5–6, slightly callous at their insertion, small, the largest—the lowest—6–7 cm. long, with 5–6 spikelets in all; secondary spathes very small, scale-like, acute or acuminate on one side; spikelets spreading after flowering, and slightly callous at their axilla, short and thick; the largest 2·5–3 cm. long with only 4–6 flowers in all; their axes acutely trigonous and sinuous; spathels with a short annular limb, extended at one side into a broadly tringular, acute point; involucrophorum shortly and thickly obconic, 3–5 mm. long, angular, slightly callous at its axilla, unilaterally extended at the apex into a comparatively large, broadly-triangular, acute point; the involucre has a short and thick base, and in parts slightly exceeds the involucrophorum, but is yet shorter than its apex, with a very short, unequal, very shallowly cupular limb; areola of the neuter flower concave, niche-like, sometimes sublunate, the scar not swollen. *Female flowers* conical-ovoid, acuminate before the anthesis, 8 mm. long; the calyx very short, about 2 mm. high, cupular with 3 very superficial but distinctly apiculate teeth, slightly furfuraceous and finely veined; the corolla is at least four times as long as the calyx, undivided for a third of its length upwards, the segments elongate-triangular, acuminate. *Fruiting perianth* explanate under the fruit. *Fruit* globose-ovoid, suddenly narrowing into a very short conical beak, 22–25 mm. long, 18–20 mm. broad; scales arranged in 14–15 longitudinal series, exactly rhomboidal and with an obtuse, not prolonged, point, narrowly and sharply grooved along the centre, of a chestnut-brown colour, almost glossy, not or only very slightly covered with a resinous exudation. *Seed* globular-ovoid, 15 mm. long, 14 mm. broad, 12–13 mm. thick, as usual pitted and ruminate; embryo almost basal.

HABITAT.—The west coast of Sumatra at Priaman (*Diepenhorst*). I have found this species a second time and in fruit, August 1878, at Ayer Mantchor near Padang (*Beccari* P. S. No. 832). Malayan name "Rotang Sigoi" (Miq.).

OBSERVATIONS.—The specimens of *D. gracilipes* collected by me at Ayer Mantchor agree perfectly with the typical specimens which I have received from the Herbaria of Utrecht and Leyden. The leaf described by Miquel (frons perbrevis flabelliformi-contracta) is evidently a radical one, and from a young plant. I have also seen a portion of an authentic specimen of Blume's *Calamus accedens* var. *brevispatha* collected by Korthals in Sumatra, and have thus been able to identify it with Miquel's *D. gracilipes.* Another specimen named *C. accedens* of Blume, which also comes from Sumatra and was collected by Praetorius, is also *D. gracilipes.*

D. gracilipes is easily distinguishable from other species of the group by its erect, non-scandent stem, and by the globular-ovoid, conically beaked, not, or only very slightly resinifluous fruit. The fruits of the specimens collected by me were almost free from resinous secretion, but those produced by plants grown in the hot-houses of my much lamented friend, the Marquis Bardo Corsi Salviati, at Sesto near Florence, derived from seeds also collected by me in Sumatra, have a very slight covering of red resin.

PLATE 48.—Daemonorops gracilipes *Becc.* The lower part of the plant; portions of a leaf from a full grown plant; portion of the upper part of a sheathed stem carrying a fruiting spadix; an entire seed; another seed bisected longitudinally along a line passing through the chalazal fovea and the embryo. From Becc. P. S. No. 832, in Herb. Beccari.

45. DAEMONOROPS MOTLEYI Becc. in Rec. Bot. Surv. Ind. ii, 224.

DESCRIPTION.—High scandent, 15–18 m. long (Motleyi). *Sheathed stem* about 2 cm. in diameter. *Leaf-sheaths* gibbous above, armed with broad, thinly laminar, elastic, subulate, solitary, or scattered, horizontal or deflexed, lead-brown spines; the mouth obliquely truncate, unarmed. *Ocrea* almost obsolete. *Leaves* rather large, the upper terminating in a long clawed cirrus; petiole 20–30 cm. long, biconvex except at the base where flattish on upper side, glabrous, and almost polished, inconspicuously longitudinally striolate, armed along the centre of the dorsum first with straight, solitary, robust spines that higher up are transformed into claws; the edges obtuse and armed with rather long, straight, horizontal spines, gradually becoming shorter towards the upper part; the upper surface is also covered with short vertical spines; rachis armed along the centre of the dorsum with, at first solitary, but higher up with 3-nate, and finally with half-whorled 5–7-nate broad-based and black-tipped claws; on the cirrus the half-whorls of claws are almost regularly spaced at intervals of 2–3 cm. without any other kind of spines being interposed; on the upper surface, the rachis is at first convex and prickly at the sides and then bifaced, the salient angle carrying remote prickles; leaflets not very numerous, very irregularly set, usually approximate in pairs on each side of the rachis, but at times solitary, with very long— up to 15–20 cm. in length —vacant spaces interposed; the pairs and single leaflets of one side alternate with or are subopposite to those of the other side; the intermediate leaflets are the largest, and are 25–30 cm. long and about 3 cm. broad, narrowly lanceolate, tapering a good deal towards the base, being usually broadest above the middle and thence shortly diminishing to a subulate, not bristly, though at the sides spinulous tip; they are rigidulous, thinly papyraceous, closely plicate, glabrous, quite bald, smooth, and sub-concolorous on both surfaces; on the upper surface the mid-costa acute, and several secondary and tertiary nerves slender, yet rather distinct; underneath all nerves are less apparent than on the upper surface; tranverse veinlets not very conspicuous but very numerous, approximate, interrupted and branched, so as to render the upper surface when dry and seen under a lens finely shagreened; margins very obscurely, appressedly and remotely spinulous; the lower leaflets are somewhat shorter than the intermediate; the uppermost are rudimentary and very narrow. *Male spadix* . . . . . *Female spadix* axillary in appearance; before flowering it is very narrowly fusiform, 20–25 cm. long, erect, apparently nodding when in fruit; it has a short, slender, flattened, acutely two-edged peduncular part with the edges spinulous; the outer spathe, before flowering, completely encloses the others, nor do the inner ones, even after the expansion of the flowers, exceed the outermost; the latter is rigid, not very thickly coriaceous, concave, elongate-fusiform, shortly acuminate, superficially two-keeled, rather densely armed all over, but specially along the keels, with short, laminar, brown-schistaceous (rusty-furfuraceous when young), more or less confluent, and sub-seriate comb-like, horizontal or slightly deflexed spines; the second spathe is slightly smaller than the outer and is prickly only on the centre of the dorsum towards the apex; the following spathes are smooth, ovate-lanceolate, concave, acuminate; the main axis is covered all over with an adherent, thin, rusty-furfuraceous indumentum and carries a very few, approximate, small partial inflorescences, exactly as in *D. didymophyllus;* spikelets short, with very few flowers, their axis rather thick, strongly sinuous, acutely 3-gonous; spathels with a short annular limb, extended at one side into a very broad and short but acute point; involucrophorum short and thick, obconical, more or less angular, extended above at one side into a triangular acute point; involucre with a short thick base, and slightly raised above the involucrophorum, flat and discoid at its upper end, where bordered by a narrow annular limb; areola of the neuter flower small, concave and niche-like, the scar not tumescent. *Female flowers* broadly conical-acute, with a flat base, 5–6 mm. long; their calyx short, cupular, with 3 very broad, superficial, apiculate lobes, rusty-furfuraceous, finely striately veined; the corolla a little more than twice as long as the calyx, parted almost down to the base into 3 triangular, acuminate segments; stigmas thickly trigonous, subulate, reaching the apex of the segments during the anthesis. *Fruit* (immature 17–18 mm. long, 13 mm. broad), ovoid, with a broad base and a round top, mucronulate scales covered with a copious, blood-red resin. *Seed* . . . .

HABITAT.—South Borneo at Banjarmassing, discovered by *J. Motley* in 1857-58, (No. 1103 in Herb. Kew.). Malayan name "Rotang Djernang laki". Motley in his field-notes writes that "the Rotang is coarse and brittle, and of no value, but it yields a small quantity of the best quality of the drug called 'Dragon's blood' extracted by shaking together the unripe fruits in bamboos; the inferior quality by boiling the residue and evaporating the extract." The name "R. Djernang" is applied by the Malays to any species of *Daemonorops* yielding Dragon's blood, and the adjective "laki", which means "male", would point to the excellency of the quality produced, as it is their custom to distinguish with the name of "laki" the best woods, fruits, or similar products, amongst those of the same nature.

OBSERVATIONS.—*D. Motleyi* is a very near ally of *D. didymophyllus*, but differs from it not only in the narrower female spadix, but especially in the more elongate and less concave spathes, of which the outermost entirely envelopes the inner spathes before the anthesis, and probably also in the fruit, which is larger and has a greater secretion of resin. There would appear to belong *D. Motleyi*, or to a transitional form between this and *D. didymophyllus*, a *Daemonorops* collected by Ridley at Puak in Sarawak, (Borneo), in September 1905 (No. 12408 in Herb. Kew.), of which another specimen is preserved in Herb. Hort. Bot. Bogor., coming from Siutang in Dutch W. Borneo. Ridley's specimen has the leaflets elongate lanceolate-elliptical, in pairs as in *D. didymophyllus*, but with occasionally a solitary one interposed, 28–32 cm. long, 3–3·5 cm. broad; the quite mature fruit is 25–26 mm. long, and 20–21 mm. broad, and is slightly covered with red resin; the seed is ovoid, slightly flattened, 16–17 mm. long, 13 mm. broad, 12 mm. thick. The fruit therefore differs from that of *D. didymophyllus* in being larger and more ovoid; further the seed is not sub-globular, but ovoid and somewhat flattened.

The specimens from Sintang have the leaflets 30–36 cm. long, 3–4 cm. broad, in pairs with occasionally a solitary one interposed; the male spadix is very narrow, about 20 cm. in length; the female spadix has the panicle 18 cm. long, and a pedicellar flattened part which is rather strongly armed on the edges as in the type specimens of *D. Motleyi*. I have not seen an entire fruit, but the scales are resiniferous; the seed is ovoid, obtusely conical at the upper end, very slightly flattened, 15 mm. long, 11 mm. broad.

The specimens now mentioned being both very incomplete and especially wanting in the spathes, do not allow of a rigorous comparison either with *D. didymophyllus* or with *D. Motleyi*. In conclusion, from what I can judge by the material I have examined, *D. Motleyi* is only a geographical form of *D. didymophyllus*.

46. DAEMONOROPS DIDYMOPHYLLUS Becc. in Hook. f. Fl. Brit. Ind. vi, 468, and in Rec. Bot. Surv. Ind. ii, 224.

D. cochleatus Teijsm. et Binn. in Cat. Plant. Hort. Bogor. (1866), Supplement, p. 381 (name only); Becc. Malesia, ii, 77, 276, 277, and in Rec. Bot. Surv. Ind. ii, 223.

Calamus (Sect. *Daemonorops*) *cochleatus* Miq. de Palm. Arc. Ind. 29.

DESCRIPTION.—Scandent, very variable in size. *Sheathed stem* 1·5–3 cm. and in very robust specimens up to 4 cm. in diam. *Leaf-sheaths* obliquely truncate and usually without spines at the mouth, sulcate or coarsely striate longitudinally, covered with a thin removable brown indumentum, irregularly armed with unequal, scattered, solitary or subseriate, laminar, broad-based, deflexed spines; the largest of these are 10 mm. broad at the base which is concave beneath, and 2 cm. long. *Leaves* 5 m. long in the pinniferous part, terminating in a somewhat slender, more or less elongate, angular, clawed cirrus; petiole 20–30 cm. long, biconvex, somewhat flattened and with rather acute edges, more or less besprinkled above with short erect prickles and with often a few, long, straight, horizontal spines on the edges as well, usually less prickly underneath; rachis in its first portion more convex above than beneath, and with broad side faces for the insertion of the leaflets; higher up the salient angle becomes acute and is more or less spinulous throughout; underneath, the rachis is armed with first solitary and then 3–5-nate half-whorled claws, especially on the cirrus; leaflets not very numerous (perhaps not more than 28–30 in all); those nearest to the petiole and the apices, solitary: all the others approximate in remote, sub-opposite or alternate pairs, the pairs 15–20 cm. apart on each side of the rachis; the leaflets of each pair are almost in contact by their bases, narrowly elliptical-lanceolate or lanceolate-ensiform, more attenuate towards the base than at upper end, where they terminate in a triangular acute and at the sides bristly-spinulous tip, green and quite free from bristles or spinules on both surfaces, longitudinally plicate, and finely striated with many slender secondary nerves; the mid-costa alone is slightly raised, and not very strong; the transverse veinlets are very minute, short, and numerous, are immersed in the parenchyme and render the upper surface minutely grained under a lens; the margins very minutely, remotely and appressedly spinulous; the intermediate leaflets are 25–35 cm. long, 3–4 cm. broad; the basilar usually narrower and longer, and those of the apex shorter and narrower. *Male spadix* before flowering nodding, rather elongate, cylindraceous and slightly clavate (40 cm. long and 2·5 cm. thick in one specimen), with a short, slender, flattened, acutely two-edged, unarmed, peduncular part which gradully broadens into the outer spathe; the latter clavate, or almost ear-shaped but split along the ventral side, 2-keeled only at its base, and, like the inner spathes, very thickly coriaceous, and entirelyc overed externally with a very thin, adherent, rubiginous, furfuraceous indumentum, transversely armed with many horizontal or slightly reversed series of short, rigid, comb-like, confluent spines; the inner spathes are 5–6 in number (not taking into account 2–3 of the apex and rudimentary) and gradually protrude one above the other; they are blunt or split-bidentate at the upper end, and are armed with the usual comb-like spines on their upper and exposed dorsal parts; the flowering panicle is strict, narrow, and with 6–7 partial inflorescences that are appressed, cupressiform, and have many branchlets; the spikelets are about 2 cm. long, and carry on the whole 10–14 not very regularly bi-seriate flowers; their axes finely rusty-furfuraceous, very slender, acutely angular and sinuous; spathels very small, bracteiform, triangular, acute; involucre of 2 opposite, triangular, acute bracts connate by their bases, similar to the spathels and about as long. *Male flowers* slender, almost linear, linear-oblong, obtuse, obsoletely angular and asymmetric by mutual pressure, 4 mm. long; the calyx shortly cupular, broadly 3-toothed; the corolla three times as long as the calyx. *Female spadix* nodding or recurved or at times erect, a good deal shorter than the male, ellipsoid-oblong before flowering, 15–30 cm. long, not including a more or less elongate, slender pedicellar part; the spathes are imbricate; the inner very slightly protruding beyond the outermost, all thinly coriaceous and of a rigid texture, oblong, concave-cymbiform or spoon-like, terminating in a short triangular and obtuse point, prickly like those of the male spadix; the outermost spathe is deeper, broader and more strongly armed than the inner; the peduncular part is 2–10 cm. long, slender, flattened, 2-edged, almost smooth, or at times strongly armed with short, robust, digitate, divergent, prickles; the main axis rather thick, covered by a very thin, adherent, rusty-furfuraceous indumentum, and carrying 5–6 partial inflorescences of which only the lowest (2–3) are branched or divided into 6–7 spikelets, while the upper ones are composed of only 1–3 small few-flowered spikelets; secondary spathes very shortly infundibuliform, extended at one side into a broadly triangular, acute point; spikelets short, the largest 3–4 cm. long with 5–6 flowers in all; their axes thickish, strongly sinuous, acutely 3-gonous; spathels with a short annular limb extended at one side into very broad and short, acute point; involucrophorum short and thick, obconical, more or less angular, extended at one side at the apex into a triangular acute point; the involucre has a short thick base, is slightly raised above the involucrophorum, and is flat and discoid above; the disc or floral torus is edged by a narrow, usually unilaterally evolute, annular limb; areola of the neuter flower concave, niche-like, the scar not tumescent. *Female flowers* conical, flat at the base, acute, 7 mm. long, their calyx cupular-obconical, with 3 very broad, superficial, apiculate lobes on the margin, rusty-furfuraceous, and finely striately-veined; the corolla a little more than twice as long as the calyx, parted down almost to the base into 3 triangular, acuminate segments; stigmas thickly trigonous-subulate, not surpassing the segments during anthesis. *Neuter flowers* 5–6. 5 mm. long, slender, similar to the male ones. *Fruiting perianth* quite explanate. *Fruit* broadly ovoid, with a very slightly conical top, very minutely mucronulate, when quite mature 17–18 mm. broad, 20–21 mm. long; scales regularly rhomboidal, obtuse, arranged in 15 longitudinal series, narrowly and rather deeply grooved along the centre, of a deep yellow-straw colour, but more or less tinged blood-red by a thin resinous covering. *Seed* irregularly globular, gibbous-ventricose on the raphal side, about 13 mm. long and about 1 mm. less in breadth and thickness, minutely pitted: embryo basal.

HABITAT.—The Malayan Peninsula, in the district of Perak (*Scortechini* in Herb. Beccari.) and in the same district at Larut, from 100—1,000 m. above the level of the sea [*King's collector* No. 2593, (♀ sp.) 5104 (♀ sp.), 6313 (♂ specimen) in Herb. Calcutt.]. In Singapore at Chan Chu Kang (*Ridley* No. 3476, Herb. Beccari.), at Buket Timah (*Ridley* No. 5875, Herb. Beccari.), at Selitar (*Ridley* No. 6277, Herb. Beccari.), at Changi (*Ridley* No. 6273 ♀, ♂ specimen in Herb. Beccari.). Specimens apparently from a young plant with sheathed stem, 12-15 mm. in diam., were collected by Scortechini at about 1,000 m. on Gunong (Mount), Tambang Batak in Perak, and bear the No. 651^b and the vernacular name of "R. Pracia". Ridley gives the Malay an name of "R. Undang" in Singapore. *D. didymophyllus* yields a small quantity of Dragon's blood.

D. didymophyllus grows also in E. Sumatra, as I consider as belonging to it a small fruit spadix preserved in the Herb. Hort. Bot. Bogor. and collected by Teijsmann at Batu Radja in the Residency of Palembang; vernacular name "Rotang Djernang ketchil".

OBSERVATIONS.—A very peculiar species easily distinguishable by its geminate leaflets, and short female spadix with oblong, very concave-cymbiform and obtuse spathes, and by its fruits slightly covered with dragon's blood resin. It is related to *D. Motleyi* of Borneo only (see observation on this species). Like almost all the other species of *Daemonorops*, it presents a great variability in its different organs, and specially in the length and armature of the pedicellar part. In specimens from Perak this part is almost spineless and very long, with the spadix therefore nodding or occasionally recurved; in others it is not more than 2–3 cm. in length, and the spadix is therefore erect; in specimens from Singapore the peduncular part is 3–5 cm. long, and more or less strongly armed with digitate, divergent spines.

D. cochleatus Teijsm. & Binn. (Rotang Buwar) which is only a synonym of *D. didymophyllus*, was indicated by name only in the "Catalogus Plantarum Horti Bogoriensis", without a word of description or any note as to its origin. I received good specimens of it from the Buitenzorg garden, but I did not recognize in it my *D. didymophyllus*, of which a description was published in the Flora of British India, otherwise I should have adopted the specific name of *D. cochleatus*, as this well defines the form of the characteristic spathes of its female spadix. The spathes of the female spadix of the "Rotang Buwar", cultivated at Buitenzorg, are more deeply concave than those of the specimens from Singapore, or in those from the Malayan Peninsula. Its native country I suppose to be South-East coast of Sumatra, probably Palembang.

PLATE 49.—Daemonorops didymophyllus *Becc.* An intermediate portion of a leaf (upper surface); a female spadix not yet expanded (in the right lower central part of the plate) from Ridley's No. 6277 in Herb. Beccari.; female spadix with young fruit (quite in centre of the plate, from Ridley's No. 5875 in Herb. Beccari.); male spadix before the anthesis, on the right-hand side (from Ridley's No. 6273 in Herb. Beccari.).

PLATE 50.—Daemonorops didymophyllus *Becc.* An intermediate portion of a leaf (under surface); portion of the sheathed stem with a male spadix before the anthesis;

portion of a spadix with full-grown fruits; one seed (from Scortechini's specimen in Herb. Beccari).

PLATE 51.—Daemonorops didymophyllus *Becc.* Portions of a specimen with female spadices from a plant cultivated at Buitenzorg under the name of *D. cochleatus* T. et B. (in Herb. Beccari).

47. *DAEMONOROPS SPARSIFLORUS Becc. in Rec. Bot. Surv. Ind. ii, 224.

DESCRIPTION.—Scandent, about 10 m. high (Lobb). *Sheathed stem* 2–3 cm. in diam. *Leaf-sheaths* more or less fugaciously rusty-furfuraceous, thick and almost woody, strongly striate longitudinally, gibbous above, powerfully armed with flat, elastic, unequal, often obliquely-inserted spines of which some are small, others large and 2—3 cm. long; they have a very broad base and thence narrow rather abruptly, to a needle-like light-coloured and often sinuous point; they have more or less fringed margins, are horizontal or slightly deflexed, usually individually distinct, but more or less aligned in oblique series; the spines at the mouths of the sheaths are not larger than the others; the mouth itself is obliquely truncate. *Ocrea* almost obsolete. *Leaves* elongate (in one specimen 1·8 m. long in the pinniferous part, terminating in a cirrus about 1 m. in length); petiole elongate, about 50 cm. long and 1 cm. broad (in one specimen), plano-convex in its basal portion; higher up it is somewhat flattened or slightly convex above; underneath it is convex, more or less sparsely prickly, or at times clawed at long intervals; the edges are obtuser variously armed with very short or 3–7 mm. long, solitary or digitate spines, some of the spines even extending on to the upper surface; at the part nearest to the edges the rachis in the first portion of its upper surface is slightly convex, and rather deeply furrowed at the sides, where the leaflets are inserted; higher up it is bifaced with an acute but not prickly salient angle; underneath it is armed as usual with 3-nate and finally, especially on the cirrus, with half-whorled rather slender claws; leaflets very numerous, very closely spreadingly and regularly equidistant, 10 on each side on a portion of the rachis 12 cm. in length, papyraceous, rigidulous, almost equally green on both surfaces, linear, not or only very slightly narrowing towards the base, where very abruptly bent backward, acuminate from far above the middle to a finely bristly tip which is slightly indented 15—20 mm. below the apex; the largest leaflets are 24—25 cm. long, 12 mm. broad; the mid-costa is sharp and bristly-spinulous above towards the apex, and is accompanied on each side by a slender, bristly-spinulous nerve; the leaflets, however, appear distinctly tri-costulate not so much because of these secondary nerves, as on account of a sharp plica running near each margin; transverse veinlets very slender, much interrupted, sinuous, not very crowded, translucent, margins remotely ciliated with rather long bristles. *Male spadix*......*Female spadix* 35–50 cm. long on the whole, apparently flattened before flowering, attached to about the middle of the uncovered portion of its leaf-sheath and carried on a very short peduncular part (1–4 cm. long); the latter is clavate, unarmed and flattish with bluntish edges; primary spathes deciduous soon after flowering, laterally flattened, and split longitudinally along one side,

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* See also page 221 for description of variety *sarawakensis* and page 223 for description of variety *crassifolius*.

each gradually protruding beyond the one immediately below and covered with a thin rusty-furfuraceous indumentum, strongly pluri-costulate-striate longitudinally, oblong-spathulate; the outermost 11–14 cm. long, armed with weak, slender, acicular, fringed, solitary spines; on the dorsal keel the spines are confluent and sub-digitate; the spathes are at their upper end truncate, densely crinite or furnished with weak, slender, non-pungent, filiform, flexible, sinuous, light-coloured, 15–20 mm. long, subspiny bristles; the second spathe does not differ from the outermost, except in being less spinous as are the following, the innermost is quite unarmed; during the anthesis the female spadix forms an erect, rigid, rather dense panicle; its main axis is slightly zig-zag sinuous, obsoletely angular with internodes 5–8 cm. long and slightly swollen at the junctures; all the axial parts are more or less fugaciously rusty-furfuraceous; the partial inflorescences are 6–7 in number, are paniculiform, very shortly stalked, erect, ovate-pyramidate and have a slender but rigid angular axis; the lower partial inflorescences, which are also the largest, are 10–14 cm. long and bear alternately, on each side, 5–7 erecto-patent, gradually diminishing spikelets; upper partial inflorescences gradually smaller and with fewer spikelets; secondary spathes not completely amplectent, very short, triangular, scale-like, acute; the lower spikelets of every inflorescence are the largest, 6—7 cm. in length; their axes are filiform, rigid, sinuous, subterete or obsoletely angular, and scabrid after the fall of the minute scurf which covers them at first; the spikelets have numerous flowers (25–30) which are alternately and almost spirally inserted, 3–4 mm. apart; spathes very small, shortly annular, slightly produced at one side into a very small bracteiform triangular point; involucrophorum slender, conspicuously pedicelliform, 2–5 mm. long (in the lower part of the spikelets longer than higher up), subterete or obsoletely angular, slightly broadened at its upper end and three edged by an inconspicuous limb; the involucre is discoidal or reduced to a flat, orbicular surface, edged by an inconspicuous margin; areola of the neuter reduced to a punctiform scar. *Female flowers* ovoid-oblong, 4–5 mm. long; the calyx obconical-cyathiform, narrowing towards the base, often obsoletely angular, finely striately-veined, truncate and with 3 very superficial, acute teeth at the mouth; the corolla twice as long as the calyx, its undivided part as long; the segments broadly triangular, acute and finely striate; the stigmas during the anthesis reach the apex of the segments and are rather short, linear-oblong and obtuse. *Neuter flowers* comparatively large, as long as the female, but considerably narrower, obsoletely angular and sinuous by mutual pressure, linear-oblong, obtuse; the calyx cyathiform, truncate with 3 very small, superficial and acute teeth; the corolla thrice as long as the calyx, both finely and striately veined. *Fruit*.......

HABITAT.—North Borneo at Labuan (*Lobb.* in Herb. Kew.). In Borneo it has been also collected by *Law* (Herb. Kew.), precise locality not given.

OBSERVATIONS.—A very peculiar species standing alone amongst those known to me by its flowers being not exactly distichally set, but almost spirally arranged round the slender axes of the spikelets. The flowers are, moreover, carried on a very slender involucrophorum, similar to that which is found in some species of *Calamus*, as for instance in *C. symphysipus.* Though apparently of the group of *D. Draco*, it is not very closely related to any of these species known to me.

48. **Daemonorops leptopus** Mart. Hist. Nat. Palm. iii, 206, 2nd edit., and 329; Miq. Fl. Ind. Bat. iii, 99; Walp. Ann. iii, 479 and v, 828; Ridley Mat. Fl. Mab. Penins. ii, 182.

Calamus leptopus Griff. in Macl. Calc. Journ. v, 73, and Palms. Brit. Ind. 82, pl. CCV., A. B.; H. Wendl. in Kerch. Palm. 236.

D. congesta Ridley l. c. p. 179.

Description.—High scandent, of moderate or rather large size. *Sheathed stem* 2–6 cm. in diam. *Leaf-sheaths* thick, woody, very hard, yellowish-brown, glabrous and almost polished, strongly gibbous above, truncate and almost spineless at the mouth, variously armed according to the size of the plant; in middle-sized specimens such as Griffith's typical ones, the spines are rigid, robust, light coloured and often black-tipped, flat, subulate, 1–3 cm. long or more at times, but frequently much smaller, occasionally solitary, but usually 2–6, being united by their bases, palmate-digitate or forming small, reverted, interrupted, and irregularly scattered series; in very robust specimens the spines are as much as 4–5 cm. in length, and when several are united together they form semi-annular, comb-like, oblique series; in very small specimens the short pointed spines form small, digitate, scattered groups; in the sinus between two contiguous spines some very slender, setiform and more or less early deciduous spiculae are usually to be found. *Leaves* rather large, 2·5–3·5 m. in length, including the petiole and a robust terminal cirrus; the petiole is 30—80 cm. long, very robust, rounded beneath and there more or less armed along the centre with usually short, solitary, or 3-nate and deflexed spines; the margins are also armed with straight, horizontal, sometimes rather long, but more frequently short, spines; on the upper surface the petiole is grooved at its base only, thence flat-surfaced, higher up slightly convex, with an obtuse salient angle along the centre; usually the upper surface is smooth, but in very luxuriant specimens it is sprinkled with small tuberculiform prickles near the base and on the margins; the rachis in its first portion is prickly at the sides, and is almost rectangular in cross section, its side faces where the leaflets are inserted are broad and flattish; higher up the rachis is bifaced, and has an acute, non-prickly salient angle above; underneath it is roundish, and armed with robust 3–5-nate claws towards the apex, and especially on the cirrus, forming half whorls that are almost regularly spaced 3–4 cm. apart; leaflets rather numerous, equidistant, alternate or sub-opposite, not very approximate (3–7 cm. apart on each side), almost equally green on both surfaces, rigidulous, narrowly lanceolate or lanceolate-ensiform, broadest not far from but always below the middle, diminishing thence towards the base, above gradually acuminate to a very fine setiform and, at the sides, bristly tip; they have a superficial, though rather distinct, bristly indentation on the lower margin near the apex; the upper surface is more or less plicate-striate, and there the mid-costa is slender and bears near its apex a few bristly spinules; the side nerves are slender and bald on both surfaces; underneath the mid-costa has at times a few scattered bristles near the apex; transverse veinlets very faint, numerous, disposed in oblique anastamosing lines; margins finely, appressedly and rather remotely spinulous, and at the apex spreadingly bristly-ciliate; the largest leaflets are 40–50 cm. long, 2·5—3 cm. broad, the uppermost shorter, and those nearest the petiole narrower.

Spadices spuriously axillary; before the anthesis they are elongate-cylindraceous, 0·8—1·2 m. in length, as thick as a finger or a little more; after flowering, nodding or recurved; primary spathes at first cylindraceous, when open almost flat or slightly concave, imbricate, narrowly lanceolate, 20—40 cm. long, 2–5 mm. in width in their broadest part (about the middle), thence almost equally tapering towards both ends, acute or obtuse or shortly bidentate at the upper end, very thickly coriaceous or almost woody, of a cinnamon colour when dry, very thinly and fugaciously rusty-fufuraceous on both surfaces but after their expansion glabrous and glossy inside; the outermost somewhat broader but not longer than the others, more or less distinctly two-keeled on the back, and armed, on the keels only, with short, straight, ascendent, horizontal or, at times, slightly deflexed, solitary, or palmate-digitate spines; inner spathes unarmed, gradually protruding beyond the one immediately below; the spathes in the male spadix apparently persist during the anthesis; in the female spadix the outermost persist also during fruit-bearing; the peduncular part of the spadix is always elongate and varies from 20 to 45 cm. in length, slender, slightly flattened, almost smooth, but at times strongly armed on the edges, especially near the insertion of the outer spathe, with straight, often fascicled, robust and divergent spines. *Male spadix* very slender, ultradecompound with 5–7 rather distant (8–10 cm. apart), rather dense, cupressiform partial inflorescences; the main axis is relatively slender, the internodes are 8–10 cm. long, irregularly cylindraceous with depressions and swellings produced by the pressure of the flowers during prefloration; partial inflorescences erect, 8—15 cm. long (shorter towards the end), all a good deal shorter than their respective spathes, very fugaciously rusty-furfuraceous in every part, each divided into 8–10 alternate, slender, slightly sinuous branches, which carry 5–6 spikelets on each side; secondary and tertiary spathes obliquely truncate and glabrous at the mouth, prolonged at one side into a triangular, very acute point; spikelets slender, the lower ones of each branchlet the largest, 15–20 mm. long, and bearing about 6–10 almost unilaterally set flowers; upper spikelets gradually shorter and with fewer flowers; spathels asymmetrically and shortly infundibuliform, extended at one side into a broadly triangular point; involucre enclosed within its spathel, semi-cupular, or of the shape of a swallow's nest, deeply excavate and bidentate on the posticous side; the axis of the spikelets are filiform, acutely trigonous, strongly indented, and bear at the insertion of each flower the impression of its form. *Male flowers* linear, oblong, bluntish, about 5 mm. long, somewhat asymmetrical from mutual pressure, erect and appressed against the axys; the calix cyathiform-obconical, with three acute triangular teeth; the corolla two and-a-half or three times as long as the calyx, divided down ¾ths of its length into three narrow externally striate segments; filaments of the stamens subulate, individually distinct, but united to the corolla in their lower part, inflected at the apex; anthers versatile, elongate, the cells deeply parted in their lower part; the rudiment of the ovary very small, divided into three short, clavate papillae, not even reaching to the free portion of the filaments. *Female spadix* decompound, with the axial parts much more robust and thicker than in the male spadix and of a quite different appearance; partial inflorescences 5–7, glabrous or fugaciously scaly-furfuraceous, a good deal shorter than their respective spathes; their axes and those of the spikelets are acutely trigonous, and bear 4–6 spikelets on each side; the spikelets are unilateral and, together with their flowers, turned towards the side opposite to the spathes; they are straight, thickish and rigid; the lowest of each inflorescence is the largest, 5–8 cm. in length, and carries two collateral and unilateral series of 6–8 flowers each; as usual the upper spikelets are shorter and with fewer flowers; spathels obliquely infundibuliform, acutely angular, extended at one side into a triangular, dorsally keeled point; involucrophorum obconically calyciform, narrowing considerably towards the base, prolonged on each side, but externally more than on the side of the neuter flower, into a triangular, dorsally-keeled, acute point; involucre very obliquely evolute and sub-auriculiform; areola of the neuter flower ovate in outline, acute, sharply bordered, the scar punctiform and not swollen. *Neuter flowers* small, acute, 3·5 mm. long; the calyx has a short tube, and three long linear teeth; the corolla is twice as long as the calyx. *Female flowers* narrowly ovate, or ovate-oblong, 5–6 mm. long, acute when in bud; the calyx is urceolate-ovoid, glabrous, finely striate externally and has three broad triangular apiculate lobes; the corolla is $\frac{1}{3}$ longer than the calyx, ventricose in its lower third, and has three lanceolate, acute segments; the filaments of the stamens are united by their bases, and form an urceole, which is connate with the undivided portion of the corolla, and has in the free part six broadly triangular, thickish (nectariflous ?), abruptly subulate teeth; anthers (sterile) lanceolate-sagittate, shorter by half than the segments of the corolla; ovary globular-ovoid; style very short and thick, crowned by the oblong clavate, strongly lamellose stigmas. *Fruiting perianth* almost explanate, but its calyx has a brief caudiculate base. *Fruit* ovoid-elliptical, small, 16–17 mm. long and about 11 mm. broad, round at the base, narrowly and acutely beaked; scales arranged in 12–15 longitudinal series, rather dull, not resiniflous, of a cinnamon-brown colour, broader than long, narrowly channelled along the centre, and with a narrow, shining, finely erosely toothed darker margin; the point round. *Seed* oblong, slightly flattened, 11–12 mm. long, 9 mm. broad, 7 mm. thick, rounded at both ends, sparsely pitted; albumen slightly ruminated by several rather shallow channels; chalazal fovea orbicular, pit-like, not very deep, situated in the centre of the raphal side; embryo quite basal.

HABITAT.—The Malayan Peninsula. First discovered by *Griffith* at Malacca; found again recently by *Scortechini* and *Sir G. King's* collectors in the district of Perak on the hills at Larut, at 100—150 m. [Herb. Hort. Calcutt. No. 4774 (♀) and No. 5919 (♀), on the Gunong Tambung Batak, at about 1,000 m. (*Scortechini*]; in Johore [*Ridley* No. 11204 (♀) and No. 11210 (♂) in Herb. Berol.].

The Malayan name, according to Scortechini is "Rotang Bachap" or "R. patapisau," this last '(break-knife)' probably on account of the hardness of its leaf-sheaths (pata "to break," and pisau a "knife").

Griffith gives for *C. leptopus* the Malay name of "R. Chinchin," but this name, as far as my knowledge goes, is applied solely to the species furnished with membranous rings around the leaf-sheaths ("chin-ching" a ring). Ridley l.c. assigns to *D. leptopus* the names of "R. Bakau" and "R. Muruseh," and gives the following additional localities :—Singapore: Baket Mandai (*Ridley* 1670, 3497), Kranji, etc.; Johore: Sungei Zebran (*Ridley* 11519); Malacca: Sungei Hudang, Bukit Kandong; Selangor: Langkat (*Ridley*).

OBSERVATIONS.—Among the species of the group of *D. Draco*, to which *D. leptopus* evidently belongs, it is easily distinguishable by its very hard, woody, almost polished leaf-sheaths; by the equidistant leaflets; by the very thick woody spathes; by the small ovoid non-resiniflous fruit; and by the oblong seed, only slightly ruminated.

I have seen portions of Griffith's type specimens of *D. leptopus*, but I have based the description mainly on Scortechini's and King's specimens.

Griffith (l. c.), after the description of *D. leptopus*, quotes (last line, p. 82) fig. IV, plate CCXVI, as giving representations of the analysis of its flowers, but certainly erroneously, for this figure represents male flowers, and Griffith describes only the female plant of the above-mentioned species.

I have reduced *D. congesta* of Ridley to *D. leptopus* after a very careful analysis of a specimen kindly sent to me by its author; it is true that this specimen (which is very incomplete, and has very immature fruits) has the spikelets with the flowers more approximate than usual; but this specimen does not appear to me quite normal.

PLATE 52.—Daemonorops leptopus *Becc.* Two portions of the sheathed stem, one with male spadix, the other with full grown fruits. From Scortechini's specimens in Herb. Beccari.

49. DAEMONOROPS OXYCARPUS Becc. Nelle Foreste di Borneo, 607, and in Rec. Bot. Surv. Ind. ii, 225.

DESCRIPTION.—Scandent. *Sheathed stem* 2·5–3 cm. in diameter. *Leaf-sheaths* coated, at first, with a white cottony fugacious tomentum, and later with a thin, adherent, persistent, dark rusty-brown covering, very conspicuously and peculiarly gibbous or swollen at the bases of the petioles, armed in a very peculiar way with epidermal formations hardly to be called spines, (for they are not or only very slightly pungent), lamelliform, or thinly papyraceous, exsuccous or scarious; they are elongate (2–3 cm. long, 3–6 mm. broad), longitudinally striately-veined, laciniate-fimbriate, or divided into many filamentose strips, deflexed, solitary, or more or less confluent; the mouths of the sheaths are very obliquely truncate and unarmed; the ocrea is very short, prolonged into a short scarious liguliform axillary appendage. *Leaves* large, about 2 m. long in the penniferous part, and terminating in a comparatively slender cirrus; petiole elongate (about 60 cm. long), biconvex from near the base, almost smooth on both faces, the edges obtuse and strongly armed near the base with rigid, needle-like, subterete or slightly flattened (non-laminar), light-coloured, 4–6 cm. long spines, of which the lower are usually geminate and divergent and the higher gradually diminish in thickness and length and are more distant; rachis in its lower portion armed beneath first with solitary, then with 3-nate, and finally on the cirrus, half whorled claws; on the upper surface the cirrus is at first obtusely convex and then bifaced with a very acute, non-prickly, salient angle; leaflets very numerous, alternate or opposite, especially towards the apex, almost equidistant, 2–3 cm. apart, linear-ensiform, slightly narrowing towards the base, and gradually acuminate upwards to a long filiform and bristly tip, 25–30 cm. long, 10–17 mm. broad, dull-green and finely longitudinally striately-veined on both surfaces; the mid-costa acute above, with one, sometimes two, slender nerves on each side of it, all carrying short spadiceous, appressed, sub-spinous bristles; beneath the mid-costa alone is finely and very closely bristly; transverse veinlets numerous, short, sinuous, much interrupted, but not very conspicuous; margins ciliate-spinulous. *Male spadix*........... *Female spadix* elongate (50–60 cm. long) before flowering, cylindraceous, slender, as thick as a man's finger, axillary in appearance, but really attached on the ventral side not far below the mouth of its sheath; the peduncular part is 9–15 cm. long, flattened, slightly broadened in its upper part, powerfully armed with short, woody, confluent, fascicled, or digitate or seriate, slightly deflexed spines; primary spathes thickly coriaceous, tubular before flowering and very obliquely truncate at the mouth; afterwards the outermost opens, is flat and oblong, has a few spines on two dorsal keels, and is more or less persistent; the others are deciduous and unarmed, with about two-thirds of their length protruding beyond that immediately below; fruiting spadix erect or nodding, and forming a loose, ovoid panicle, 40–45 cm. in length, with 5–6 partial inflorescences; axial parts more or less covered with a thin rusty-furfuraceous indumentum; the main axis is very irregularly angular, slightly flattened, marked by depressions and gibbosities which are due to the pressure of the adjoining parts during prefloration; the partial inflorescences are spreading, and have a very conspicuous axillary callus with a transversal fovea; the lowest and intermediate inflorescences are 10-14 cm. long and have only 3-4 distichous spikelets on each side; the upper ones are smaller and have very few spikelets; secondary spathes very short, scale-like, slightly prolonged at one side into a small triangular point; spikelets rather slender, very spreading, with strong axillary calluses and rigid, angular, and rather strongly zig-zig sinous axes, 5–7 cm. long with very few (3-5) bifarious flowers on each side; spathels very short, subannular, prolonged at one side into a small, triangular, acute point; involucrophorum pedicelliform, clavate, angular, usually 1–2 mm., but at times as much as 4 mm in length, distinctly callous at its axilla, slightly widened at its apex on one side into a broadly triangular point; involucre discoid, slightly exserted from the involucrophorum, with the broad flat terminal disc bordered by a very narrow almost inconspicuous margin; areola of the neuter flower punctiform, slightly callous. *Female flowers* very slender, almost linear, slightly narrowing towards their upper ends, 5·5–6 mm. long, and only about 2 mm. broad at the base; the calyx is shortly obconical, strongly striately-veined, and it has on the margin three triangular acuminate teeth, which terminate in a small tuft of hairs, persisting to the maturity of the fruit; the corolla is twice as long as the calyx, urceolate, and undivided to about the middle; its segments are linear, acute *Fruiting perianth* non-explanate, pedicelliform with a flat base, due to the hardened base of the calyx and of the tubular part of the corolla. *Fruit* narrowly elliptical, almost equally narrowing towards both ends, gradually conically beaked above, 22-23 mm. long, 10 mm. broad; scales rather glossy, small, arranged in 12 longitudinal series, each series composed of at least 12 well-formed scales (omitting the rudimentary one of the beak) of a cinnamon-brown colour, with a darker undefined intramarginal band; the margin itself very narrow, scarious, distinctly ciliate-denticulate; the point round. *Seed* oblong (not seen quite mature).

HABITAT.—Borneo: In Sarawak at Kuching (*Beccari* P. B. Nos. 1932 and 250); at Labuan (*Lobb* in Herb. Kew.). The Malayan name in Sarawak is "Rotang mignac". The strips cut from its stem are very strong and extremely tough, and are therefore frequently used to fasten the iron blade of the "Bilion" (the Malay axe) to its handle. Low, who also collected this species in Borneo (Herb. Kew.), gives the name of "Rotang putte duri" (Rotang having white spines).

OBSERVATION.—*D. oxycarpus* is a very well marked species, easily distinguishable by the large swelling at the base of the petiole; by the membranous laciniate formations which take the place of true spines on the leaf-sheaths, and by the ellipsoidal elongate fruit which gradually narrows upward to a conical beak and downwards to an acute base.

PLATE 53.—Daemonorops oxycarpus *Becc.* The upper portion of a leaf-sheath with the petiole and the lower part of a female spadix (in situ) before the anthesis (on the left hand side of the plate); from Becc. P. B. No. 250. A fruiting spadix; an intermediate portion of a leaf, upper surface; portion of the sheathed stem; from Becc. P. B. No. 1932.

DAEMONOROPS OXYCARPUS var. LEVIPES Becc.

Differs from the "forma typica" in the leaf-sheaths, which are quite smooth and entirely devoid of the peculiar sub-foliaceous spines, but are furnished with the same conspicuous globose gibbosity at the base of the petiole.

HABITAT.—Dutch N.-W. Borneo at Lianggagan in the Residency of Sambas. (*Hallier* No. 2594, in Herb. Hort. Bot. Bogor.).

50. DAEMONOROPS MICROSTACHYS Becc. in Rec. Bot. Surv. Ind. ii, 225.

DESCRIPTION.—Small. Stem erect, about 1 m. high (Lobb). *Leaf-sheaths* 15–18 mm. in diam., not gibbous above, open on the ventral side a long way down, rusty-furfuraceous, armed with flat, brown-tipped, otherwise light-coloured, 1–2 cm. long, horizontally seriate, but individually distinct spines, and with other spines much smaller interposed between the series of the larger; a few spines 4–5 cm. long stand erect near the mouth of the leaf-sheath. *Ocrea* inconspicuous. *Leaves* non-cirriferous (always?); petiole rather elongate, smooth and concave on the upper surface near its base, flat higher up, underneath strongly convex and armed along the centre, at intervals of 3–4 cm., with solitary, straight, and slightly deflexed spines, which change into light-coloured claws higher up; the edges are not very acute, and are armed towards the base with a few straight, spreading, 2–3 cm. long spines, which in prefoliation point upwards and leave upon the petiolar surface deep impressions of their outline, gradually becoming shorter higher up and disappearing where the leaflets begin; the rachis is laterally on the upper surface deeply grooved at first and then has an acute, non-prickly, salient angle, and flat side faces; underneath it is at first convex and armed with remote claws while towards the upper end it is flat and unarmed; leaflets rather numerous, equidistant, not very closely set (3–4 cm. apart on each side), light green on both surfaces when dry, papyraceous, rigidulous, narrowly lanceolate, broadest below the middle and thence narrowing towards the base, above gradually acuminate into a subulate bristly tip, slightly indented on the lower margin not far below the apex; the mid-costa acute and smooth above with one slender nerve on each side stronger than the other secondary nerves, and bristly spinulous from the middle to the apex; underneath the mid-costa alone bears several spreading bristles from the middle upwards; the transverse veinlets are very numerous, approximate, much interrupted, and give to both surfaces a finely shagreened appearance; margins acute, bristly-spinulous near the apex only; the intermediate leaflets are 35–45 cm. long, 18–20 mm. broad; those of the base are 22–25 cm. long, 15–16 mm. broad; the upper ones are shorter, less acuminate and have a few bristles at the apex; the two of the terminal pair are the shortest, almost obtuse, and quite free at their base. *Male spadix* . . . . . *Female spadix* very slender, 20 cm. long on the whole (in one specimen) with a very slender peduncular part which is about 7 cm. long., flattened, 2–3 mm. broad, rusty-furfuraceous, its edges armed with short spines which point different ways; primary spathes apparently 5 in number, coriaceous, scaly-furfuraceous externally, glabrous and striate inside; the outermost persistent after flowering, elongate, ear-shaped, armed with a few solitary, straight, spreading spines on the dorsum and with a few similar spines near the edges; the second spathe has only a few spines along the centre of the dorsum near the apex; the other spathes, each of which gradually protrudes beyond that immediately below, are explanate during the anthesis, and soon deciduous, oblong, obtuse, about 7 cm. long, 12–18 mm. broad, unarmed; the flowering panicle is small, vate-thyrsoid, rather dense, 10 cm. long (in one specimen), rusty-furfuraceous in every part; its main axis is slender, obsoletely angular, striolate, and has 5 erect, small (3–4 cm. long) partial inflorescences; the latter with the exception of the terminal one which is much reduced in size, are 3–4 cm. long, and carry 4–5 distichous spikelets on each side; secondary spathes very small, annular, slightly extended at one side into a small scale-like limb; the largest spikelets are the lowest of every inflorescence and are 15–20 mm. long, and have 8-10 alternate unilaterally set flowers in all; the axis is angular, slightly sinuous and minutely scabrid; spathels excessively short, annular, inconspicuously extended at one side into a very small, scale-like, acute limb; involucrophorum very shortly obconical, rather thick, angular, truncate at the upper end, where slightly extended at one side into a very small, triangular, acute point; involucre almost on a level with the involucrophorum, completely flat, discoid, orbicular, edged by an extremely narrow, acute, annular limb; areola of the neuter flower very small, punctiform. *Fruiting perianth* obconical; the calyx short, cupular, with 3 very superficial, apiculate teeth; the corolla at least thrice as long as the calyx, its segments triangular, strongly veined externally. *Fruit* . . . . .

Habitat.—North Borneo. On the hills near Bruni (*Lobb* in Herb. Kew.).

Observations.—Of this species I have seen only a spadix with growing ovaries, and a portion of a leaf. It belongs evidently to the group of *D. Hystrix*, though it is a non-climber. It is probably the smallest known species of *Daemonorops*, if it is not a case of nanism of *D. Hystrix.*

PLATE 54.—Daemonorops microstachys *Becc.* From the type specimen in the Herbarium at Kew.*

51. DAEMONOROPS HYSTRIX Mart. Hist. Nat. Palm. iii, 205, 2nd edit. and 328, pl. 176, f. IV, 3–4; Miq. Fl. Ind. Bat. iii, 91; Walp. Ann. iii, 447 and v, 828; Teijsm. Cat. Bog. (1866) 74; Hook. f. Fl. Brit. Ind. vi, 469; Becc. in Rec. Bot. Surv. Ind. ii, 226; Ridley Mat. Fl. Mal. Penins. ii, 183 (excl. syn.)

Calamus Hystrix Griff. in Calc. Journ. Nat. Hist. v, 71, and Palms Brit. Ind. 80, pl. CCIV, ABC; Miquel De Palm. Arc. Ind. 28; H. Wendl. in Kerch. Palm. 236.

Dæmonorops hirsutus Bl. Rumphia, iii, 21 (only as to the leaves) pl. 135 (excl. f. D. E.); and pl. $\frac{163}{B}$, f. D. Miq. Fl. Ind. Bat. iii, 92, and Prodr. Fl. Sum. 256 and 593 (partly) as in the following citations; Walp. Ann. iii, 477 and v, 828; Teijsm. Cat. Bog. 1866, 74.

Calamus (sect. *Daemonorops*) *hirsutus* Miq. De Palm. Arc. Ind. 28; H. Wendl. in Kerch. Palm. 236.

Daemonorops hirsutus β brevifolia Bl. Rumphia, iii, 21; Miq. Fl. Ind. Bat. iii, 92; Miq. in Jour. Bot. Néerl. i, 19.

DESCRIPTION.—Scandent, very variable in size. *Sheathed stem* 2–4 cm. in diam. *Leaf-sheaths* gibbous above, at first rusty-furfuraceous, later glabrous, their mouths usually very conspicuously armed with several erect, at times exceptionally long, (as much as 20–30 cm.), flat, thinly laminar, broad (5–8 mm. at the base), light-coloured or spadiceous, straight or slightly sinuous spines, which when very numerous are obliquely inserted, especially on the anterior side; the spines on the surface of the sheaths are shorter than those near the mouth, but of the same type, and are usually 1–3 cm. long, very thinly laminar, almost foliaceous, fringed at the margins when young, narrowly lanceolate-acuminate, solitary or seriate and occasionally confluent and transversely seriate, horizontal or deflexed. *Ocrea* very short. *Leaves* usually 1–1·6 m. long in the pinniferous part, at times shorter, terminating in a more or less elongate cirrus; petiole rather elongate (30–45 cm. long or at times less), slightly flattened, equally convex on both surfaces, or, in very robust plants, with a very obtuse, salient angle above; its edges obtuse, more or less armed near the base with straight, long and short, usually 1–4 cm. long, ascendent spines; on the intermediate portion the spines are shorter and horizontal, and towards the upper end gradually transformed into claws; on the undersurface the petiole is smooth, or slightly armed along the centre near the base with a few straight spines, and upwards with a few claws, being usually quite smooth in the middle; sometimes both surfaces, especially near the edges, are also armed with very short, erect, straight prickles; the rachis is smooth or remotely spinulous above, is convex here in its first portion, and has an acute salient angle with flat side faces in the remainder; underneath in its first part it is convex and armed with solitary claws, in the remaining portion it is flattish and the claws are 3-nate, 5-nate, and finally half-whorled on the cirrus. Leaflets numerous (about 100 on the whole in vigorous plants), equidistant, 2–3 cm. apart, frequently almost opposite, the upper ones more distant and smaller; they are very narrowly linear-lanceolate, diminishing towards a rather acute base, and very gradually acuminate from below the middle to a very slender subulate tip, green on both surfaces; above they are sub-tricostulate or have the mid-costa acute and one rather slender nerve on each side of it stronger than the other secondary nerves, and like the mid-costa, sparingly bristly from the middle upwards; underneath, the mid-costa, and 1–2 nerves on each side of it, of which one lies very near to each margin, are covered throughout with an almost uninterrupted line of very close, small, appressed bristles; transverse veinlets rather inconspicuous, short, not very approximate, and much interrupted; margins minutely not very closely and appressedly spinulous; the spinules more spreading and longer towards the apex: in vigorous specimens the leaflets attain 40 cm. in length and 14–16 mm. in breadth, usually they are 25–30 cm. by 12–14 mm. *Spadices* axillary in appearance, but really inserted near the mouths of their respective sheaths, exactly opposite to the base of the petioles. *Male spadix* externally not differing from the female one (seen by me only in a young stage). *Female spadix* before flowering, rigid, erect, slender, slightly arched, terete, 15–20 mm. in diam., in vigorous plants 60–80 cm., but, frequently only 40–50 cm. long; primary spathes thickly coriaceous, at first tubular and narrowly ear-shaped, obliquely truncate, and usually shortly bi-dentate at the upper end, each protruding a good deal from that immediately below; the outermost is usually long persistent, after the anthesis more or less spread open, spathulate above, elongately sub-infundibuliform and diminishing towards the base, glabrous and glossy inside, greyish or rusty-furfuraceous or at times glabrescent externally, more or less armed on the back, especially near its base, with flat, short and broad, solitary or confluent, or even seriate or digitate, laminar spines; not infrequently a few broad, laminar spines are also to be found on the edges near the apex; inner spathes smaller, deciduous; the 2nd, 3rd and 4th gradually less spinose, the others unarmed; peduncular part of the spadix short (3–6 cm. in length), usually more or less prickly, at least at the sides; the axial parts more or less covered with a very thin rusty-furfuraceous, partially evanescent, indumentum; the main axis is subterete in its lower part, irregularly angular higher up and bears 5–10 partial inflorescences which are erect when bearing the flowers and spreading later when loaded with fruits, and more or less callous in their axilla; the lowest partial inflorescences are 12–15 cm. long and bear 4–6 alternately bifarious, spreading spikelets on each side; their axes are straight, rigid and more or less distinctly 3–4-gonous; upper partial inflorescences shorter and with fewer spikelets; secondary and tertiary spathes very short, annular, slightly produced at one side into a short acute triangular point; spikelets at first erect, then spreading, and finally, when loaded with fruits, horizontal, 4–8 cm. long, and with 5–7 bifarious flowers on each side; their axes rather slender, 1·5–2 mm. thick, angular and slightly sinuous; spathes very short, annular, produced at one side into a small scale-like, amplectent, broadly triangular, acute point; involucrophorum

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* See also page 224 and plate 104.

distinctly pedicelliform, subtrigonous, about 2 mm. long, narrowing towards the base, at first appressed, later spreading, and with a distinct axillary callus, truncate at the upper end and produced at one side into a very short scale-like limb; involucre slightly raised above the involucrophorum, perfectly flat, round, disciform, edged by a very narrow limb; areola of the neuter flower small, punctiform, slightly callous. *Neuter flowers* linear, acuminate, 5 mm. long, angular, and more or less flattened; the calyx superficially 3-dentate; the corolla 3–4 times as long as the calyx, divided down past the middle into three narrow acute segments; filaments of the stamens subulate, free amongst themselves, but adnate in their lower third to the corolla; anthers sagittate-lanceolate; rudiment of the pistil very small, formed by 3 short papillae. *Female flowers* trigonous-pyramidate, acute, with a flat 3 mm. broad base, when in bud about 6 mm. long; the calyx shortly cupular, truncate with 3 superficial teeth which usually terminate in a small tuft of hairs; the corolla 4 times as long as the calyx, ventricose in its lower half, and thence divided into 3 lanceolate-triangular acute segments; the filaments of the stamens, by their united bases, form an urceolum, which is adnate to the tubular part of the corolla and is crowned with 6 short, triangular, acute, and strongly tumescent (nectarifluous?) teeth in their free part; anthers narrowly sagittate-lanceolate, half as long as the segments; ovary globular; stigmata obovate-oblong, thick, strongly lamellose inside, deciduous after flowering. The fruiting panicle is rather diffuse, ovate-oblong. *Fruiting perianth* obconical-campanulate; the segments of the corolla spreading or deflexed. *Fruit* (in the most typical forms) ovoid-elliptical or oblong, 15–17 mm. long (without the perianth), 9–11 mm. broad, round at both ends, caudiculate at its base, beaked mammillate at the apex; scales arranged in 12 longitudinal series, each series composed of 7–8, not taking into account the smaller at the extremities, almost regularly rhomboidal, broader than long, rather dull, of an uniform light and dirty straw colour, with a narrow darker or even lighter intramarginal line, and a finely erosely-toothed margin, superficially and narrowly grooved along the centre, more convex near the apex than in their basal part, the apex itself round. *Seed* very regularly oblong, rounded at both ends, 11 mm. long, 7–8 mm. broad, slightly flattened, finely pitted; the chalazal fovea small, placed in the centre of the raphal side; albumen ruminate, or penetrated by numerous narrow channels filled with a dark resinous matter; embryo exactly basal.

HABITAT.—The Malay Peninsula. Near Malacca at Ayer Punnus and at Rhim (*Griffith*). In the district of Perak (*Scortechini* No. 5036 in Herb. Beccari). Sungei Ryah (*King's collector* Nos. 951 in Herb. Calcutt.). Johore (*King* in Herb. Calcutt.). Singapore (*Ridley* No. 3479 and 3489), idem at Buket Mandai (No. 3480 and 3486), idem Garden Jungle (No. 5876). Griffith gives the Malay name of "R. Sabote" probably, "R. Sapatu" (=a shoe), on account of the shape of the outermost spathe. This however, seems a generic name for all the species of *Daemonorops* which have the outer spathe like that of *D. Hystrix.* Scortechini affixes to it the name of "Rotang Tanah." Ridley gives also the following localities: Penang Hill (*Curtis*); Selangor: Batu Tiqa (*Ridley*); Pahang: Kwala Lipis (*Machado*). The native name "Rotang Sabut." Ridley also says that the rattans are used in rigging for boats.

Not essentially differing from the specimens coming from the Malay Peninsula are some with fruit and leaves, collected by Teijsmann at Rio; these have an oblong fruit, 18–20 mm. long, including the perianth, and 11 mm. broad, and have the spikelets at times branched, and each branchlet with 3-5 flowers.

I consider as belonging to *D. Hystrix* some fruits of a Sumatran *Daemonorops* which I have seen in the Herbaria of Leyden and Utrecht, but especially a fruiting spadix collected by Teijsmann at Muara dua in the Residency of Palembang (No. 3592 Herb. Hort. Bot. Bogor.). This spadix, however, has the peduncular part densely prickly all round as in *D. oblongus.*

Observations.—According to Griffith, *D. Hystrix* is an extensive climber. Sir George King's collector assigns 3·5–5 m. to the plants from which he had gathered his Herbarium specimens. Apparently the plants of *D. Hystrix* begin to flower when still very young and have a short stem, but this may acquire with time a great length. It is however a very polymorphic species, and varies not only as to the general size of the plant, but also as to the degree of spinescence of the leaf-sheaths, petioles and spathes, and also as to the dimensions of and relation between the length and breadth of the fruit. *D. Hystrix* is very closely related to *D. oblongus* and *D. Korthalsii*, the first being its representative form in Java, and the second in Borneo. In *D. Hystrix* the spines round the mouth of the leaf-sheaths are longer, broader, and usually more numerous than in *D. oblongus* in which the peduncular part of the spadix is a good deal more densely armed, and the spines are more slender more closely set and oftener confluent than in *D. Hystrix*; the leaflets of *D. oblongus* have on the under surface 3–5 rather remotely bristly nerves, while in *D. Hystrix* the 5 nerves are covered with a continuous line of very minute and closely set bristles; further the fruit of *D. Hystrix* is never so elongate and cylindraceous as that of *D. oblongus.* For the differences with *D. Korthalsii* see the observations on that species, and regarding *C. hirsutus* see the observations on *C. oblongus.*

What Griffith has written at p. 81 of his large work belongs to *D. Hystrix* to the heading that begins: "The following additional particulars," etc., which particulars are referable to a species with fascicled leaflets, which I have been unable to identify.

Plate 55.—Daemonorops Hystrix *Mart.* (Forma typica). The upper part of a leaf-sheath and base of the petiole with a young female spadix in situ; two very young female spadices; an entire-panicle with full grown fruits; the upper end of a leaf (undersurface); seeds, from raphal and anti-raphal side; seed longitudinally cut through the chalazal fovea and the embryo. From specimens in Herb. Beccari collected by Ridley in Singapore.

Daemonorops Hystrix var. minor Becc. in Hook. f. Fl. Brit. Ind. vi, 469.

Calamus Hystrix var. Griff. l. c.

Description.—Smaller, 1–3 m. high. *Sheathed stem* 1–2 cm. in diameter. *Leaves* 60–70 cm. in length including the petiole and cirrus; leaflets 14–15 cm. long, 9–10 mm. broad. In one specimen the fruiting spadix is only 12 cm. long, in others 30–40; spikelets with only 2–4 flowers on each side. The spines at the mouth of the leaf-sheaths are 10–15 cm. long, and of the usual form; otherwise the leaf-sheaths are armed as in the type, but to a smaller degree. The primary spathes are feebly armed, and usually only along the centre of the dorsum; often they have an acute apex. The fruit is considerably less elongate than in the type, is ovoid or at times subglobular-ovoid, 12–14 mm. long (not including the perianth) and 10 mm. broad; the scales are arranged in 15 longitudinal series, 6–7 in each, not counting those not well developed at the ends. *Seed* globular-ovoid, 8 mm. long, 6·5 mm. broad.

HABITAT.—The Malayan Peninsula at Larut in the District of Perak (*Scortechini* in Herb. Beccari), also *King's collector* Nos. 5097 and 1882 in Herb. Calcutt.

OBSERVATIONS.—It is impossible to draw a line of strict demarcation between this variety and the type, each exhibiting so many intermediate forms between them. Griffiths mentions this variety under the Malay an name "R. Pusa isur"; probably a misprint for Pusa ikor ("Pusa" a cat and "ikor" a tail) on account of the form of its small tail-like spadix, before flowering.

PLATE 56.—Daemonorops Hystrix *var.* minor *Becc.* From specimens collected by Scortechini in the District of Perak (Herb. Beccari.).*

52. DAEMONOROPS ELONGATUS. Bl. Rumphia iii, 16; Mart. Hist. Nat. Palm. iii, 329; Miq. Fl. Ind. Bat. iii, 93; Walp. Ann. iii, 478 and v, 828; Becc. in Rec. Bot. Surv. Ind. ii, 226; Ridley Mat. Fl. Malay Penins. ii, 185 (excl. syn.).

Calamus (Sect. *Daemonorops*) *elongatus* Miq. Anal. Bot. Ind. 6, and De Palm. Arc. Ind. 28; H. Wendl. in Kerch. Palm. 236.

DESCRIPTION.—Apparently not very high scandent, or suberect. *Sheathed stem* 2·5–3·5 cm. in diam. *Leaf sheaths* not or only very slightly gibbous above, their mouth armed (as in *D oblongus*) with several very long, straight, laminar, blackish or spadiceous spines; on the body the spines are numerous, subulate, flat, rigid, 1–3 cm. long, ascendent or spreading, brown, solitary and scattered. *Leaves* rather large, 1–1·5 m. long in the pinniferous part and terminating in a not very long and slender cirrus; petiole elongate, 35–50 cm. long, 8–10 mm. broad, slightly concave above near the base, plano-convex in the intermediate portion, and more or less biconvex higher up, smooth or slightly prickly on the upper surface; underneath armed along the centre with straight, deflexed spines and also more or less with small scattered prickles; the margins are rather obtuse and carry several rigid, robust, subulate, 2–7 cm. long, spreading or horizontal spines, of which the lower are the longest; rachis armed beneath at first with rather long, suddenly deflexed, solitary claws, which become 3-nate higher up; on the upper surface the rachis has at first an obtuse but from the middle upwards acute salient angle, smooth throughout, with flat side faces; leaflets rather numerous, inequidistant but not distinctly grouped, alternate or sub-opposite; in each group, in the intermediate portion, they are 1·5–3 cm. apart, with the naked spaces between the groups 4–6 cm. in length, green and almost glossy on both surfaces, papyraceous, very narrowly lanceolate or lanceolate-ensiform, broadest not very far above the base, narrowing thence shortly towards it, and upward gradually acuminate to a finely subulate and, at the sides, bristly-spinulous tip; on the upper surface the mid-costa is slender and sharp, spinulous only near the upper end, and accompanied on each side by a slender secondary nerve (stronger however than several other nerves of the same kind) furnished with several short blackish bristles; underneath, the mid-costa alone is more or less minutely bristly-spinulous; transverse veinlets very sharp on both surfaces, numerous and much interrupted; margins finely and closely spinulous; the largest leaflets are those a little above the base which are 25–28 cm. long, 18–20 mm. broad in Motley's Bornean specimens, and as much as 35–40 cm. long and 25 mm. broad in the cultivated plants; the leaflets towards the upper end are gradually shorter and more spaced. *Spadices*, male and female, very similar, before flowering very narrowly cylindrical and elongate, slightly arched and nodding; primary spathes coriaceous, at first tubular, each protruding considerably beyond that immediately below, obliquely truncate at the mouth; after the anthesis the outermost spathe spreads out and is narrowly elliptical or elliptical-lanceolate or at times subspathulate or spoon-shaped, gradually diminishing towards the base to a more or less elongate, sparsely prickly and flattened pedicellar part; it also narrows slightly above to a shortly bidentate apex, is reddish brown and polished inside and more or less rusty-furfuraceous externally, where it is entirely covered with small solitary, more rarely digitate, scattered, deflexed, brown spines, which rest on a lighter and sub-bulbous base; inner spathes deciduous, broadly linear, briefly bi-dentate at the upper end, more or less striate longitudinally; the second rather densely, the others sparingly prickly towards the apex, the ultimate spathes unarmed. *Male spadix* 40–75 cm. long; the flowering panicle strict, very slenderly fastigiate and with 6–8 partial inflorescences, more or less persistently rusty-furfuraceous in every part; its main axis is cylindraceous or obsoletely angular, as slender as a pack-thread, usually marked by numerous small depressions; partial inflorescences about 10 cm. long, cupressiform and appressed to the main axis, (the ultimate smaller), formed by 10–12 branchlets, each bearing 8–10 gradually diminishing fastigiate spikelets; secondary and tertiary spathes small, very shortly embracing, produced at one side into a short bracteiform, triangular, acute point; spikelets small, filiform, the lower (largest) 9–10 mm. long, and with 8–10 unilaterally set flowers; their axes irregularly sinuous, and strongly indented at the insertions of the flowers which are often in pairs; spathes very small, produced at one side into a triangular, not very acute point; involucre very small, with the limb reduced to a very narrow annular rim round the circular scar. *Male flowers* very small, oblong, 3–5 mm. long; the calyx very shallowly cupular, with 8 small acute teeth; the corolla several times longer than the calyx. *Female spadix* about as long as the male or rather shorter; the peduncular part sometimes 20 cm. long, usually less, flattened, more or less armed all round with deflexed, solitary or confluent, and subdigitate, straight, rather short spines: it slightly broadens above, where it gradually passes into the first spathe; the flowering panicle is oblong, formed by 6–7 partial inflorescences; the main axis is straight, has the lowest internodes short, terete, and about 5 mm. in diam. while the other internodes are more or less angular; the secondary and tertiary spathes are very small, scarious,

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* See also page 224 and plate 105 for description of *D. Hystrix* var. *exulans*.

annular-amplectent, briefly produced at one side to a triangular point; the partial inflorescences have a distinct axillary callus, are triangular in outline, about 15 cm. long and have 6–7 bifariously and regularly alternate, spreading, gradually diminishing spikelets on each side; the axis of the inflorescences is straight, very acutely 3–4-gonous with very narrowly winged angles; the lower spikelets (the largest) are 6–7 cm. long, and have 8–10 bifarious flowers on each side, their axis very acutely angular and zig-zag sinuous; spathels scarious, very short, annular-amplectent, produced at one side into a triangular, spreading, acute point; involucrophorum distinctly pedicelliform, 2–4 mm. long, angular, slightly narrowing towards the base, very spreading or horizontal when bearing the fruit; it has a distinct axillary callus, is truncate at the upper end, and there produced at one side into a triangular acute point; involucre slightly raised above the involucrophorum, its limb represented by a very narrow annular rim round the flat orbicular surface upon which the flower rests; areola of the neuter flower rather small, concave, niche-like, not callous. *Female flowers* small, 4 mm. long, the calyx very shallowly cupular, with 3 very superficial acute teeth, the corolla 4 times as long as the calyx, callous at its base, parted down past the middle into 3 broadly triangular, acute, sharply striately veined segments. *Fruiting perianth* very broadly obconical, and very shortly pedicelliform. *Fruit* small, globular-ovoid, 9 mm. in diam., shortly and suddenly but distinctly conically beaked, 12–13 mm. long (including the beak and perianth); scales arranged in 13–15 longitudinal series, glossy, narrowly grooved along the centre, rhomboid, with a very slightly produced obtuse point, greenish-yellowish, with a lighter, scarious, erosely toothed edge. *Seed* globular, 7 mm. in diameter; albumen ruminate, embryo basal.

HABITAT.—South Borneo. It was based by Blume upon the specimens collected in the interior of the Province of Banjarmassing by *Henrici*; found again at Banjarmassing by *Motley* (No. 672 and No. 1170 in Herb. Kew.). Motley says that it produces a strong but coarse Rotang.

Apparently belonging to *D. elongatus* is a *Daemonorops* collected by Ridley in February 1896 in Pulo Pinang at Balik Pulau (No. 7905 in Herb. Kew. et Calcutt.).

Ridley gives other localities for *D. elongatus*, but I have not seen his specimens, except No. 7905.

OBSERVATIONS.—Amongst the species of the group of *D. Hystrix*, which have the leaf-sheaths armed at the mouth with very long, erect, spines, *D. elongatus* is easily distinguishable by its leaves with inequidistant leaflets, and by its small, globular-ovoid, beaked fruit.

I have based my description mainly on the specimens cultivated at Buitenzorg, comparing these with Blume's authentic ones; in these some of the leaflets are as much as 50 cm. long and 28 mm. broad. Motley's specimen No. 1170 is smaller than those of Blume; the leaf-sheaths are only 15–18 mm. in diam. and the leaflets are but 25–28 cm. in length, and 18–20 mm. in width; the spadix is 35 cm. long, including the pedicellar part. Motley's No. 672 has still smaller and more rigid leaflets, and the collector notes that the plant has a calamoid stem, but is generally short and erect, 7 feet high, densely tufted. Ridley's specimen from Pulo Pinang mentioned above agrees pretty well with the type specimens of *D. elongatus*, only the fruit scales are in 18, not in 15, longitudinal series.

Ridley reduces to *D. elongatus* Bl. *D. Kunstlerii* Becc., a quite different species. Probably some of the localities attributed by Ridley to *D. elongatus* belong to *D. Kunstlerii.*

PLATE 57.—Daemonorops elongatus *Bl.* Male spadix during the anthesis, and another not yet expanded, in the central part of the plate; female spadix with growing ovaries; spadix with full grown fruits; the upper part of a leaf-sheath, and the petiole. From a specimen cultivated in the Botanic Garden at Buitenzorg (Herb. Beccari).

53. DAEMONOROPS CURRANII Becc. in Philip. Journ. Sc. ii (1907), 238.

DESCRIPTION.—Scandent and of moderate size. *Leaf-sheaths* . . . . . *Leaves* terminating in a not very long and slender cirrus, which is very regularly armed with approximate half-whorls of very sharp confluent claws; petiole . . . . ; the leaf-rachis (in the intermediate portion) is slightly convex beneath, where it is strongly and regularly armed with half-whorls of 5-nate claws and has a very sharp and spinulous salient angle above and flat-side faces; leaflets numerous, equidistant, about 4 cm. apart, green and sub-shining on both surfaces, papyraceous, very narrowly lanceolate or lanceolate-ensiform, broadest not very far above the base and thence shortly narrowing downwards, gradually acuminate to a subulate and, at the sides, spinulous tip; on the upper surface the mid-costa is slender and sharp, spinulous only near its apex, and accompanied on each side by a slender secondary nerve which is stronger than some other nerves of the same kind and spinulous; underneath the mid-costa alone is minutely bristly spinulous; transverse veinlets very slender and sharp especially on the upper surface; the intermediate leaflets 33–40 cm. long, 17–20 mm. broad. *Female spadix* before flowering very narrowly cylindrical and elongate, slightly curved; primary spathes at first tubular, very obliquely truncate at the mouth and produced at the apex into a triangular point, later longitudinally split; the outermost spathe, after flowering, elongate-spathulate, gradually narrowing towards the base into a rather short, flattened, prickly, pedicellar part, completely and very densely armed externally with solitary or more or less seriate and confluent, deflexed, short, unequal spines, which have a reddish-brown tip, and a lighter swollen base; inner spathes prickly only on the back, especially near their apex, smooth on the margins at the mouth; when in flower or fruit the female spadix is thinly rusty-furfuraceous in every part, about 60 cm. long, slender, rigid, with 6–7 partial inflorescences; the peduncular part of the spadix is 7–8 cm. long, 7–8 mm. broad, slightly flattened, very slightly enlarged upwards, armed with deflexed, solitary or confluent and sub-digitate, straight, rather short, deflexed spines; the main axis (of the spadix) is straight, its lowest (2–3) internodes slightly flattened, the others obsoletely angular; secondary and tertiary spathes inconspicuous; partial inflorescences triangular in outline, the lower, the largest, 11–12 cm. long; the upper shorter, with 5–7 bifarious, regularly alternate, spreading spikelets on each side; the axis of the partial inflorescences straight, very acutely 3–4-gonous; the lower spikelets, the largest, 3·5–4·5 cm. long, with 6 to 9 bifarious flowers on each side, their axes very acutely angular, and zig-zag sinuous; upper spikelets shorter, and with fewer flowers; spathels scarious, very shortly annular and embracing, produced at one side into a triangular spreading acute point; involucrophorum shortly but distinctly pedicelliform, 1–2 mm. long, angular, very spreading or horizontal when bearing the fruit, distinctly callous in its axilla, truncate and with a very short triangular point at one side at its apex; involucre slightly raised above the involucrophorum, its limb represented by a very narrow annular rim round the flat orbicular scar left by the flower: areola of the neuter flower rather small, concave, niche-like, not callous. *Female flowers* 5 mm. long when in bud, with an ovate base and a trigonus apex; the calyx very shallowly cupular with 3 broad acute teeth; the corolla 4 times as long as the calyx, parted down almost to the base into 3 elongately triangular, sharply striately veined segments. *Fruiting perianth* very broadly obconic and therefore not distinctly pedicelliform. *Fruit* small, spherical, very shortly and broadly conically beaked, 12 mm. in diameter when quite ripe; scales in 12–14 longitudinal series, polished, narrowly and sharply grooved along the centre, exactly rhomboid, with an obtuse tip, straw-yellow with very narrow almost entire margins. *Seed* globular, slightly depressed, 10 mm. broad, 8 mm. high its surface pitted and tubercled.

HABITAT.—The Philippines: Palawan, *H. M. Curran*, February 1906 (No. 3791, Herb. Manill.); Mindanao, Camp Keithley, Lake Lanao, September-October 1907, *Mary Strong Clemens* (No. 1280 in Herb. Manill.)

OBSERVATIONS.—*D. Curranii* is a near ally of *D. elongatus* Bl., from which it differs in the leaves having equidistant leaflets; in the leaf-sheaths armed with slender seriate, very approximate spicular, instead of scattered, laminar spines; in the rachis being spinulous on the salient angle; and in the slightly larger fruit.

To *D. Curranii* I refer the plant collected by Mrs. Mary Strong Clemens in Mindanao (Camp Keithley, Lake Lanao, September-October 1907), although endowed with some peculiarities by which it differs from the type of *D. Curranii* growing in Palawan. The following are its principal characteristics :—*Leaf-sheaths* 2–5 cm. in diam., armed with irregular rows of stiff bristle-like spiculae, which are 15–20 mm. long, more or less united by their bases so as to form a narrow laminar raised crest; the mouth of the leaf-sheaths is armed with many, imbricate, very long, laminar, ascendent, blackish spines; the petiole is rather elongate, subterete-biconvex being very slightly flattened, armed all round with very short ascendent prickles; rachis also more prickly on the salient angle of the upper surface than in the type; leaflets numerous, equidistant, 2–3 cm. apart, with the mid-costa, and 2 nerves on each side of it, bristly-spinulous; underneath the mid-costa alone bristly-spinulous. *Female spadix* with a pedicellar part covered with stiff bristles which are united by their often swollen bases. *Fruit* (not quite mature) globose-ovoid; scales with a narrow, dark-brown, intra-marginal line all round. *Seed* ovoid, 8–8·5 mm. long.

D. Curranii from Mindanao differs from that growing in Palawan in its leaflets having 5 bristly-spinulous nerves above instead of 3, and by the pedicellar part of the spadix being entirely covered with stiff bristles, which are united in their basal parts, and form thick callous sub-cristate bodies. The fruit and the seed seem also more ovoid in the Mindanao than in the Palawan plant.

PLATE 58.—Daemonorops Curranii *Becc.* Leaf; fruiting spadix, and near this a female spadix in flower from the Palawan plant (No. 3791 Herb. Manill.); portion of a leaf-sheath and fragments of the spadix (on the left side of the plate) from Mindanao, (Clemens, No. 1280 Herb. Manill.).

54. DAEMONOROPS OBLONGUS Bl. Rumphia, iii, pl. 140, 141, (1845?) and pl. 142 f. D. (excluding figs. A. B. C. which belong to *C. adspersus*) and p. 25. (this page published in 1849 according to Martius, Hist. Palm. iii, 326, foot note); Mart. l. c. 205 (2nd edit.) and 326; Walp. Ann. iii, 477 and v, 828; Miq., Fl. Ind. Bat. iii, 91; Teijsm. Cat. Hort. Bog. 74.

Calamus oblongus Reinw. in Bl. Cat. Hort. Buit. 59 (as from Bl.) and in letters to Martius in Mart. l. c. iii, 207 (1st edit.) and l. c. pl. 160 f. IV, 1–3 (fruit only); Roem. &. Schult. Syst. Veget. vii, 2, 1323 (only as to the Javan plant, all other synonyms excluded); Kunth, Enum. Pl. iii, 206; Miq. De Palmis Arc. Ind. 28.

Calamus platyacanthus Mart. l.c. 206, 1st. edit. (only as to the plant from Java and excl. syn.) pl. 160 (excl. f. V and IV, which figures belong to *C. adspersus*); Kunth Enum. Pl. iii, 205 (excl. many syn.); Miq. De Palmis Arc. Ind. p. 28.

Daemonorops platyacanthus Mart. l. c. 204 and 328; Walp. Ann. iii, 477 and v, 828; Miq. Fl. Ind. Bat. iii, 90.

Daemonorops hirsutus Bl. Rumphia, iii, 21, pl. 135 D. E. and pl. $\frac{163}{B}$ D (excluding pl. 135 figs. A. B. C, which apparently belong to *D. Hystrix*).

DESCRIPTION.—Scandent, of middle or rather large size. *Sheathed stem* 3–4 cm. in diameter. *Leaf-sheaths* gibbous above, fugaciously rusty-furfuraceous, their mouths very peculiarly armed with several erect, very long (10–15 cm.), straight, flat, thinly laminar, 2–4 mm. broad at the base, blackish or spadiceous spines, which when very numerous are obliquely inserted and imbricate, especially on the anticous part of the mouth; the spines which cover the surface of the sheaths are shorter than those round the mouth, but of the same type, and are usually 2–4 cm. long and up to 4–5 mm. broad at the base, very thinly laminar, almost foliaceous, fringed-furfuraceous on the edges when young, narrowly lanceolate-acuminate, solitary or seriate or confluent as well and half-verticilled, horizontal or deflexed. *Ocrea* very short. *Leaves* rather large, 1·2–1·5 m. long in the pinniferous part, terminating in a more or less elongate cirrus; petiole elongate (30–50 cm. long), light-coloured, slightly flattened, equally convex on both surfaces, its edges obtuse, more or less armed throughout with straight, ascendent, spreading or divergent spines from a few mm. to 1–4 cm. in length; the spines are usually longest near the base; the upper surface is smooth or sparsely-prickly, underneath it is usually armed along the centre and specially near the base with a line of long, straight, deflexed spines; the rachis in its lower portion has a more or less distinct groove on each side for the insertion of the leaflets, and is convex above, the convexity gradually becoming a very acute, salient angle, more or less spinulous towards the upper end; underneath, the rachis is at first armed with solitary, then with 3–5-nate, and on the cirrus with half-whorled claws; leaflets very numerous, equidistant also in the terminal part, 2–3 cm. apart, often almost opposite, papyraceous, rather rigid, green, concolorous on both surfaces, linear-lanceolate, broadest in the middle and thence gradually acuminate to a very slender, subulate, more or less bristly tip, 25–30 cm. long, 15–18 mm. broad, the upper leaflets somewhat smaller; on the upper surface they are tricostulate, or have the mid-costa acute (bristly-spinulous towards the upper end), with one secondary nerve stronger than the others on each side of it, and bristly from a little above the base; underneath are 5 nerves not very closely nor very minutely bristly; transverse veinlets rather numerous, and rather sharp on both surfaces, much interrupted; margins minutely, closely, and not very appressedly spinulous. *Spadices*, male and female, externally very similar, elongate, cylindraceous, slender, as thick as a man's finger, slightly curved, with a very short prickly peduncular part or almost sessile; primary spathes thickly coriaceous, at first tubular and slightly ear-shaped, obliquely truncate, and usually shortly bidentate, each of them protruding a good deal beyond that immediately below; the outermost long persistent after flowering, more or less flat or slightly concave, at least in its upper part, then spathulate-cuneiform, being broadest near the apex, and thence gradually narrowing towards the base, glabrous and glossy internally, grayish or rusty-furfuraceous or at times glabrescent externally, armed more or less on the back, especially near its base, with flat usually triangular, short and broad, but occasionally elongate, scattered or confluent, and seriate or else digitate spines; not unfrequently a few long, slender, erect spines are to be found near the upper end; inner spathes smaller, deciduous, the 2nd, 3rd and 4th gradually less spinous, the others unarmed; the axial parts more or less covered with a thin rusty-furfuraceous, partially evanescent indumentum. *Male spadix* usually smaller than the female one, 30–50 cm. long; the flowering panicle very slender and strict, its main axis subterete and 3-5 mm. in diam. at its base, irregularly angular and as thick as a pack-thread upwards; partial inflorescences 6–8, appressed to the main axis, narrowly fastigiate-cupressiform, 7–10 cm. long and with 8–10 branchlets; secondary spathes very small, scale-like, extended at one side into an erect triangular, acute point; branchlets with 8–10 fastigiate, gradually shortening spikelets the largest (lowest) of these are 10–12 mm. long and have 10–12 unilaterally set flowers, which are usually in pairs; the upper spikelets are gradually shorter and have fewer flowers; their axis is slender, filiform, and indented at the insertion of every flower; spathels very small, obliquely extended at one side into an amplectent, triangular obtuse point; involucre formed by a very inconspicuous annular limb round the small circular surface upon which the flower rests. *Male flowers* very small, oblong, obtuse, 3·5 mm. long, 1 mm. thick, covered with a fine, rusty-pulverulent, removeable scurf; the calyx very small, broadly trilobate; the corolla several times longer than the calyx, very finely striate. *Female spadix* more robust than the male, 40—60 cm. long, fastigiate-cupressiform while in flower, afterwards when in fruit forming a loose, ovate, erect or slightly nodding panicle; the lower internodes of its main axis are 2–4 cm. long, 7–8 mm. in diam., and are almost terete, the upper internodes are irregularly angular; partial inflorescences 7–10 in number, at first erect, ultimately spreading, more or less distinctly callous at their axilla, 12–15 cm. long, with 5–6 alternately bifarious spreading spikelets on each side, their axes straight, rigid, and more or less distinctly 3–4-gonous; the upper inflorescences are shorter and have fewer spikelets; secondary and tertiary spathes very short, annular, membranous, slightly produced at one side into a triangular, acute point; spikelets at first erect, then spreading, slightly callous at their axilla; the lower (largest) are 5–7 cm. long and have 7–9 bifarious flowers on each side, their axes are rather slender (1·5–2 mm. thick) angular and somewhat sinuous; spathels very short, annular-amplectent, produced at one side into a small, scale-like, broadly triangular, acute point; involucrophorum distinctly pedicelliform, subtrigonous, 1–4 mm. long, narrowing towards the base, at first appressed, later spreading, and with a distinct axillary callus, truncate and with a very short, scale-like limb at one side, at the upper end; involucre somewhat raised above the involucrophorum, perfectly flat, disciform, with the limb reduced to a very narrow annular rim round the circular scar; areola of the neuter flower slightly concave, niche-like and with a small basilar, non-swollen scar. *Neuter flowers* 4 mm. long, more slender and more acuminate than the male; the corolla several times longer than the calyx which is very small. *Female flowers* while in bud trigonous-pyramidate, acute, 5 mm. long; the calyx very shallowly cupular or almost flat, truncate, and with three very superficial teeth; the corolla several times longer than the calyx, ventricose and undivided in its lower third, the segments triangular, acuminate, strongly striately-veined. *Fruiting perianth* very broadly obconical, subpedicelliform. *Fruit* (when quite mature) oblong-cylindrical, rounded at both ends, the apex minutely mammillate, 20–25 mm. long, 10–11 mm. in diam.; scales in 15 longitudinal series, each series composed of 11–12, not reckoning the rudimentary ones, narrowly and sharply grooved along the centre, almost regularly rhomboidal, broader than long, rather dull or slightly glossy, of a uniform straw-colour with a slightly darker but faint intramarginal line, and a lighter, scarious, finely erosely-toothed margin; the tip obtuse. *Seed* oblong-cylindrical, rounded at both ends, 18 mm. long or at times less, 7 mm. thick, very slightly tubercled and pitted; the chalazal fovea very indistinct, superficial and in the shape of a small fissure almost in the centre of the raphal side; the albumen ruminate or penetrated by numerous very narrow channels; embryo exactly basal.

HABITAT.—On the volcanic mountains of the west part of Java, and probably also in S.E. Sumatra, (*Zollinger* No. 2301 in Herb. Boissier). In Java it receives the name of "Rotang" or "Hoh-eh tartas."

OBSERVATIONS.—*D. oblongus* is, in Java, the representative species of *D. Hystrix* It is very closely related to the latter but apparently specifically distinct by not very striking yet numerous characteristics; of these, the most conspicuous are the more élongate cyclindraceous fruit; the shorter spines at the mouth of the sheaths; the leaflets, though bristly on five nerves beneath, have the bristles not very close together, and do not form a continuous line as in *D. Hystrix*; further the female flowers of *D. oblongus* have the calyx almost flat, and therefore several times shorter than the corolla, while in *D. Hystrix* the calyx is shortly cupuliform, and the corolla four times as long as the calyx; the involucre protrudes beyond the involucrophorum farther than in *D. Hystrix*, and the areola of the neuter flower is more evolute, concave and niche-like.

The specimens of *D. oblongus* upon which Blume, Martius and Miquel have worked, consisted of mixed up parts of more than one species, a fact which caused many errors. The inspection, however, of most of the authentic specimens, and the study that I have made of very complete specimens of the true *D. oblongus*, gathered from plants cultivated at Buitenzorg, has enabled me to disentangle the intricate synonymy of this species. I have thereby discovered that *D. platyacanthu* Mart. and *D hirsutus* Bl. are in a great measure the same as *D. oblongus*. The first description of *C. oblongus* Reinw. appeared in Martius' large work in the first edition of the page 207 of Vol. III; this species must, therefore, be considered as established on the peculiarly elongate fruit figured by Martius in plate 160 f. IV, 1. 2. 3, but the leaf-sheath attributed to it, and represented in f. V of the same plate 160, is really that of *Calamus adspersus*. Martius's *D. platyacanthus* is wholly *C. oblongus*, and the spadix reproduced by him in pl. 160 is really that of this species, but with young fruit. To *D. oblongus* belongs also the leaf-sheath represented in f. III of that plate, but without the peculiar spines at its mouth, for these had been mutilated in the specimen used for that plate, as I have been able to prove by the authentic specimen.

Daemonorops hirsutus Bl. is apparently *D. Hystrix* growing in Sumatra as to the leaves (Rumphia iii, pl. 135, f. A. B. C.) and *C. oblongus* as to the fruit (Rumphia iii, pl. 135 D. E. and pl. $\frac{163}{B}$ D.)

D. hirsutus var. *brevifolius* is apparently made up of the fruit of *D. oblongus*, and the leaves of *D. trichrous*.

PLATE 59.—Daemonorops oblongus *Mart.* Upper part of a leaf sheath and base of the petiole; an intermediate portion of a leaf (upper surface); male spadices, one before the anthesis, the other after it. In centre of plate, a portion of female spadix in flower; a fruiting panicle: two detached spikelets with very elongate fruits. All parts from plants cultivated at Buitenzorg in Herb. Beccari.

55. **Daemonorops Korthalsii** Bl. Rumphia, iii, 23, tab. $\frac{163}{B}$ C; Mart. Hist. Nat. Palm. iii, 328 ; Miquel Fl. Ind. Bat. iii, 92 ; Walp Ann. iii, 478 and v, 828; Becc. in Rec. Bot. Surv. Ind. ii, 226.

Calamus (sect. *Dæmonorops*) *Korthalsii* Miq. Anal. Bot. Ind. 6, and De Palm Arc. Ind. 28.

Description.—Scandent, of moderate size. *Sheathed stem* 22–25 cm. in diam. (in one specimen). *Leaf-sheaths* gibbous above, coriaceous and almost woody, rusty-furfuraceous, strongly striate longitudinally, the mouth obliquely truncate, and armed with a number of large, erect, straight, thinly laminar, elastic, 7–8 cm. long spines; otherwise the entire surface, and the base of the petiole above the gibbosity is armed with numerous, rather large (2–3 cm long, 3–5 mm. broad), thinly laminar, brown-schistaceous, spreading or deflexed, usually solitary and scattered spines which when young have fringed furfuraceous edges and are set in a line along the ventral side; near the mouth the spines are smaller, but very crowded and ascendent. *Ocrea* inconspicuous. *Leaves* 1·5 m. long in the pinniferous part and terminating in a slender, elongate cirrus; petiole elongate (50 cm. in one specimen), biconvex with the edges very obtuse, except at the base, where they are rather acute, and armed with a few, straight, and long spines, otherwise the edges especially on the upper surface, are armed with very small, short and straight, solitary or more or less aggregated prickles; underneath, the petiole has a few straight spines at its base along its centre, otherwise it is smooth but for some small, solitary prickles which appear only where the leaflets begin; the rachis is convex above in its first portion, then bifaced, with a very acute salient angle, smooth throughout; underneath the claws, at first solitary, become as usual 3-nate and 5-nate upwards, and half-whorled on the cirrus; leaflets numerous, equidistant, 2–3 cm. apart on each side, papyraceous, green, dull, paler beneath, linear-lanceolate, broadest about the middle or a little below, and thence gradually narrowing towards the base, and upwards into a finely subulate and filamentous tip; they are distinctly 3-costulate on the upper surface where the mid-costa is slightly stronger than the 2 side nerves and all 3 or the middle one only bristly-spinulous from the middle upwards; on the under-surface 5–7 nerves are very closely covered with very small bristly spinules; transverse veinlets very distinct, rather numerous, much interrupted; margins minutely and very appressedly spinulous, the lower margin on the upper surface bordered by a very narrow shining band. *Spadices* before flowering erect, cylindraceous, as thick as a man's finger; primary spathes thickly coriaceous, almost woody, at first tubular or narrowly ear-shaped, each projecting a good deal beyond that immediately below; the outermost more persistent than the others, after flowering opening flat, at least in its upper part spathulate-cuneiform, gradually narrowing to the base from near the upper end; the apex broadly bidentate (in one specimen), rusty-furfuraceous externally and armed over the entire surface with very short and very broad, flat, often confluent or seriate or at times laciniate, slightly deflexed, brownish spines, glabrous and shining internally; inner spathes smaller, deciduous, gradually less spinous, the ultimate smooth. *Male spadix* erect, very shortly pedicellate, the flowering axis furfuraceous, very slender, strict and cupressiform-fastigiate, in one specimen 40 cm. long, with 6–7 also very slenderly cupressiform, erect partial inflorescences; the main axis is as thick as a pack-thread, subterete; the branchlets are numerous and carry 8–10 spikelets which are not bifariously set, but turned outwards, are very small and have a very slender filiform axis, are about 1 cm. long and have altogether 3–4 unilaterally set flowers; spathels and involucre inconspicuous. *Fruiting spadix* nodding, 85 cm. long (in one specimen), with 9–10 partial inflorescences and a very short (3 cm.) unarmed, rather thick, clavate peduncular part; all the axial parts are covered with a thin persistent rusty-furfuraceous indumentum; the main axis is subterete and rather thick (6–7 mm. in diam.) in its lower part, and is irregularly angular higher up; secondary spathes small, annular, scarious; partial inflorescences in the fruiting stage erecto-patent, with a distinct axillary callus, rather large; the intermediate are the largest and are 20 cm. long, with 6–7 perfectly alternately bifarious and almost horizontal spikelets on each side: the lowest inflorescences are slightly smaller; the ultimate are much reduced in size and number of spikelets; the axis of the inflorescences is straight, rigid, acutely and irregularly 3–4-gonous, almost winged on the angles, and is gradually narrowed towards the upper end; spikelets rigid, with a distinct axillary callus; the lower of each of the partial inflorescences which are the largest, are 7–8 cm. long and have 7–8 bifarious flowers on each side; their axes are rather slender, angular, and somewhat sinuous; spathels very short, annular, embracing, produced at one side into a small, scale-like, broadly triangular, acute, spreading point; involucrophorum very shortly pedicelliform, angular, short (1–2 mm. long), thickish, slightly narrowing towards the base, distinctly callous in its axilla, truncate, and with a very short scale-like limb at one side at its upper end; involucre barely protruding beyond the involucrophorum, perfectly flat-disciform with the limb reduced to a very narrow annular rim; areola of the neuter flower small, punctiform. *Fruiting perianth* very broadly obconical, shortly pedicelliform; the calyx very shortly cupular, furfuraceous, with three very superficial small teeth which terminate in a tuft of hairs; the corolla at least thrice as long as the calyx, undivided in its lower half, its segments broadly triangular, deflexed. *Fruit* oblong, almost equally rounded at both ends, minutely mammillate on the summit, 18–19 mm. long, including the perianth, 11 mm. thick; scales arranged in 15 longitudinal series, of a dirty straw-yellow colour, slightly darker on the very convex obtuse point, narrowly grooved along the centre, with a very narrow, finely, erosely-toothed edge. *Seed* oblong, equally rounded at both ends; albumen ruminate; embryo basal.

HABITAT.—Borneo; on Mount Sakumbang in the S. E. part (*Korthals*); in Sarawak on Mount Mattang near Kuching (*Beccari* P. B. No. 1938) and at Puak (*Ridley*, September 1905, No. 12405, in Herb. Kew.); in Dutch N. W. Borneo at Sanggouw, Residency of Sambas (*Hallier* No. 873 in Herb. Hort. Bot. Bogor.).

OBSERVATIONS.—*D. Korthalsii* is the representative in Borneo of both *D. oblongus* and *D. Hystrix;* it is distinguishable from either by the leaflets having 5–7 finely and closely spinulous nerves on the undersurface; by its involucrophorum being very short and thick; by its fruit being more rounded at both ends; and by the axial parts being acutely angular and covered with an adherent, brown, furfuraceous indumentum.

PLATE 60.—Daemonorops Korthalsii *Bl.* Portion of a sheathed stem with male spadices; upper end of a leaf (upper surface); the lower portion of a spadix with full-grown fruits. From P. B. No. 1938 in Herb. Beccari.

56. DAEMONOROPS RIEDELIANUS Becc. in Rec. Bot. Surv. Ind. ii, 226.

Calamus (sect. *Daemonorops*) *Riedelianus* Miq. De. Palm. Arc. Ind. 19 and 28; H. Wendl. in Kerch. Palm. 237.

DESCRIPTION.—Apparently scandent. *Sheathed stem* 2–2·5 cm. in diam., very densely and almost uniformly armed with small, short, very dark, laminar, scattered or obsoletely seriate spines, intermingled with numerous small spiculae. *Leaves* rather large; the petiole broad, 10–12 mm. at its base, flattened-biconvex above it, very densely spinous all round, but especially above where set with ascendent, straight, 5–10 mm. long spines; the rachis, in the intermediate portion, convex and armed with ternate claws beneath, above with the salient angle slightly prickly; leaflets numerous, equidistant, 3–3·5 cm. apart, linear-ensiform, broadest below the middle, thence tapering slightly towards the base, and gradually acuminate to a bristly tip, papyraceous, rather rigid, green and concolorous on both surfaces, subtricostulate, with an acute and prominent mid-costa, and one secondary nerve, stronger than the others, on each side of it; transverse veinlets slender, but rather sharp, almost equally distinct on both surfaces, moderately crowded, sinuous and interrupted; margins ciliated with rather close, blackish, spreading spinules. *Male spadix* .... *Female spadix* very similar to that of *D. Gaudichaudii*; primary spathes ......; spikelets about 3 cm. long with 4-5 flowers on each side, at first fugaciously-furfuraceous, then glabrescent, their axes angular, sinuous; spathels annular, slightly prolonged at one side into a broadly triangular acute point; involucrophorum pedicelliform, 2 mm. or at most 3 mm. long, non-callous at its axilla, appressed to the axis, angular, narrowing considerably to the base, very obliquely produced at the upper end into a broad, triangular, subacute limb; involucre thick, slightly protruding beyond the involucrophorum, flat, disciform, orbicular, with a very narrow annular margin; areola of the neuter flower concave, niche-like, with a slightly callous punctiform scar. *Fruiting perianth* sub-explanate or obsoletely and broadly obconical, and subpedicelliform. *Fruit* spherical, 13 mm. in diam., very shortly umbonate-mammillate; scales in 18 longitudinal series, of a uniform hazel-nut-brown colour, almost glossy, clearly and narrowly grooved along the centre, with a very narrow, scarious, erosely-toothed edge, regularly rhomboidal, broader than long, the point obtuse. *Seed* irregularly globular, slightly flattened on the raphal side, 10 mm. long and broad, 8 mm. thick; chalazal fovea small, pit-like, round, placed in the centre of the raphal side; albumen deeply ruminated; embryo almost basal, slightly shifted to the anti-raphal side.

HABITAT.—Celebes: Menado in the Province of Minahassa (*Riedel*) Vernacular name "Angah," but I find this name also applied to *D. macropterus*. At Menado it had been collected also by *Koorders* (No. 18389β in Herb. Hort. Bot. Bog.).

OBSERVATIONS.—I have seen a few fruits of authentic *D. Riedelianus*, in the Leyden Herbarium, and other fruits of the same gathering, accompanied by a very small portion of a leaf, in the Utrecht Herbarium.

Koorders's specimen consists of an entire fruiting spadix, an intermediate portion of a leaf, and a portion of a leaf-sheath. The fruiting spadix is about 40 cm. long and bears 5 partial inflorescences; these are appressed to the main axis, small, and have few spikelets; the peduncular part of the spadix is slender, densely prickly all round; the fruit and seed are exactly like those of the type specimens; the leaflets, however, are narrower, about 30 cm. long and 15 mm. broad, and have the mid-costa and one nerve on each side of it bristly spinulous on the upper surface; beneath only the mid-costa is rather closely bristly throughout.

In the type specimen the leaflets are 23–24 mm. broad and 30 cm. long, with 3 bristly nerves above, while underneath 3, and occasionally 4 nerves are more or less bristly.

D. Riedelianus is very closely related to *D. Gaudichaudii*, from which it differs in the armament of the leaf-sheaths, in its smaller fruit, and in the seed, which has an almost basal embryo, whereas in *D. Gaudichaudii* the embryo is almost on the antiraphal side.

57. DAEMONOROPS KUNSTLERII Becc. in Hook. f. Fl. Brit. Ind. vi, 469; and in Rec. Bot. Surv. Ind. ii, 226.

D. elongatus (non Bl.) Ridley, Mat. Fl. Mal. Pen. ii, 185 (partly?).

DESCRIPTION.—Erect, 60 cm. to 1 m. high, or at times somewhat elongate (Scortechini). *Sheathed* stem 2–3·5 cm. in diameter. *Leaf-sheaths* 2–3·5 cm. in diam. thickly coriaceous or almost woody, slightly gibbous above, split open a long way down the ventral side, abundantly covered with dark furfuraceous scurf, densely armed with unequal spines of which several are 2–2·5 cm. long, rather robust, flat, rather broad, greyish brown, rigid, obliquely inserted, more or less seriate, but individually distinct, and with a conspicuous lighter coloured basilar swelling; intermingled with these are other very slender spines, spiculiform or acicular; near the mouth the spines are ascendent and up to 5–10 cm. long. *Leaves* paripinnate or shortly cirriferous, elongate, about 1·5 m. long, not including the petiole; the latter also elongate (45–50 cm.), 1 cm. broad, fugaciously grey-furfuraceous, smooth, on the upper surface very slightly channelled near the base, flattish with a slightly salient angle higher up; beneath convex and armed along the centre, especially near the base, with a line of long, robust, straight spines; its margins armed near the base with similar robust, spreading, and at the base callous spines; rachis armed beneath with, at first solitary, but near the upper end 3-nate, or even 5-nate claws; the upper surface is at first convex, but the flat side-faces soon unite to form an acute, smooth, salient angle; leaflets numerous, equidistant, 2·5–3 cm. apart, 30–40 cm. long, 11–15 mm. broad, gradually shorter towards the upper end, papyraceous, rigidulous, green and concolorous on both surfaces, linear-ensiform, broadest a little above the base and thence very gradually acuminate to a subulate tip, tricostulate and plicate-striate, on the upper surface the mid-costa slender but very sharp, glabrous or with only a few straggling bristles near the apex; on each side of the mid-costa runs a slender secondary nerve bristly from near the base and stronger than a few others of the same kind; transverse veinlets very numerous, approximate and short; margins very minutely and appressedly spinulous. *Male spadix*..................*Female spadix* before flowering elongate-cylindraceous, erect, as thick as a man's finger, 50–55 cm. long (including a peduncular part 18–20 cm. in length) arched and nodding when in fruit, covered in every part, but specially on the spathes, with a very soft, rusty, easily removable, and in the end deciduous, furfuraceous tomentum; the peduncular part is subterete, very slightly flattened, subclavate, and gradually passes into the outer spathe, is very densely armed with very unequal, small, fascicled or seriate, divergent, deflexed spines; primary spathes thickly coriaceous, oblong, bidentate at the apex; the inner protruding each considerably beyond the one immediately below; the outer, most armed, especially along two dorsal obsolete keels, with a line of small straight-deflexed spines; the second spathe has a few spines along the centre of the dorsum; all the others are unarmed; the spines of the spathes and of the peduncular part are like those of the leaf-sheaths, of a greyish-brown colour, and have a conspicuous light-coloured swelling at their base; the panicle is formed by 6–7 partial inflorescences, and when in flower is fastigiate–cupressiform, when in fruit loosely ovate; the axial parts are covered with a thin, more or less persistent, furfuraceous indumentum; the main axis has the lower internodes cylindraceous or slightly clavate, 3–4 cm. long, 4–5 mm. in diameter; the other internodes slightly and unequally flattened; secondary and tertiary spathes very small, annular, scarious, very slightly produced at one side; partial inflorescences erect-spreading with a distinct axillary callus; they are 10–12 cm. long and have 4–5 bifariously spreading spikelets on each side; their main axis is rigid, acutely angular; the lower largest spikelets are 6–7 cm. long and have 6–7 bifarious flowers on each side; the upper are somewhat shorter, and have fewer flowers; their axes are sinuous, angular; spathels annular, very short, scarious, very slightly produced at one side into an acute point; involucrophorum distinctly pedicelliform, 2–5 mm. long, callous at its axilla, angular, tapering slightly towards the base, flat and truncate at the upper end, almost without a limb; involucre on a level with the involucrophorum, flat, discoid, orbicular, also with no distinct limb; areola of the neuter flower obsolete. *Female flowers* 6 mm. long, very narrowly trigonous-pyramidate, acuminate, with a flat base; the calyx shortly cupular, with 3 very superficial teeth; the corolla about 5 times as long as the calyx, divided almost halfway down into 3 triangular, acutely pointed segments. *Neuter flowers* either inconspicuous or altogether absent. *Fruiting perianth* very broadly obconical and therefore very shortly pedicelliform. *Fruit* exactly spherical or sometimes slightly depressed, 16–17 mm. in diameter, beaked mammillate at the apex; scales arranged in 18 longitudinal series, very narrowly grooved along the centre, of a uniform hazel-nut-brown colour, with very narrow, lighter coloured, scarious, almost entire margins, rhomboidal, broader than long, not at all produced at the apex. *Seed* globular, minutely tubercled, 11–12 mm. in diameter; albumen with numerous narrow channels penetrating almost to the centre; embryo basal.

HABITAT.—The Malayan Peninsula: on Gunong Tambang Batak in the district of Perak (*Scortechini* No. 652^C in Herb. Beccari); on the hills of the same district (*King's collector*, No. 10204 in Herb. Calcutt.).

OBSERVATIONS.—It is certainly closely related to *D. vagans*, but the latter is a scandent plant, whereas *D. Kunstlerii* appears to be erect, has the leaf-sheaths armed with individually distinct although seriate spines, and split open on the ventral side in their upper parts, which gradually pass into the petiole without the gibbosity so characteristic of the scandent species. In *D. vagans* the leaf-sheaths are obliquely truncate at the mouth, and are armed with confluent spines, which form several membranous transverse spinuliferous crests. The fruit of *D. Kunstlerii* is slightly larger than that of *D. vagans*, and has 18 longitudinal series of scales instead of 15; the leaflets are longer and comparatively narrower in *D. Kunstlerii* than in *D. vagans*.

I have described Scortechini's specimens, which have a female spadix not yet open and another with quite mature fruit. In the Calcutta specimens the fruit is immature, and is therefore smaller and narrows more gradually to the beak; the leaflets are also larger, as much as 55 cm. long, and 23–24 mm. broad, but otherwise identical with those of Scortechini's specimen. In the flowering female spadix I have been unable to discover any trace of a neuter flower; also in the spikelets, when bearing the fruits, the areola of the neuter flower is quite obsolete.

Ridley (l. c.) wrongly reduces *D. Kunstlerii* to *D. elongatus* Bl.

PLATE 61.—Daemonorops Kunstlerii *Becc.* Female spadix in flower; upper portion of the stem with an entire spadix in fruit; one seed entire and the two halves of one longitudinally cut through the embryo. From Scortechini's No. 652^C in Herb. Beccari.

58. DAEMONOROPS VAGANS Becc. in Hook. f. Fl. Brit. Ind. vi, 469, and in Rec. Bot. Surv. Ind. ii, 226.

DESCRIPTION.—Scandent, rather slender, 4·5–8·5 m. high. *Sheathed stem* 17 mm. in diameter (in one specimen). *Leaf-sheaths* gibbous above, obliquely truncate at the mouth, armed with numerous bristle-like, black spiculae, intermingled with flat laminar, deflexed spines, united by their bases to form several transverse, interrupted, and irregular crests; a few erecto-patent, long and strong spines occur near the mouth. *Leaves* elongate, 2–2·2 m. long including the petiole and cirrus; petiole rather elongate, slightly flattened-biconvex with very obtuse margins which are powerfully armed, especially near their base, with robust, long, straight, slightly deflexed spines; the dorsum is also armed near the base with deflexed spines; the rachis in the upper part of the leaf is acutely trigonous, beneath flat, and armed with rather strong 3-nate and on the cirrus 5-nate claws; on the upper surface it has an acute, smooth, salient angle, and flat side-faces; leaflets equidistant or nearly so, not very approximate (about 4 cm. apart) green on both surfaces, slightly paler beneath, papyraceous, rigidulous, linear-lanceolate, broadest about the middle or a little below, tapering thence towards the base and gradually acuminate above to a subulate and bristly tip, the latter having a rather distinct indentation (marked by a small tuft of bristles) on the lower margin, not far from the apex ; the leaflets are sub-tricostulate above, with an acute mid-costa, spinulous near the apex only, and one secondary nerve on each side of it, stronger than the others, and sprinkled with short blackish bristles ; on the under surface the mid-costa alone has short bristles near the apex ; transverse veinlets very minute and innumerable, short and much interrupted, almost equally visible on both surfaces ; margins acute, very minutely and very appressedly spinulous ; the largest leaflets of the upper part of the plant are 30 cm. long, 15 mm. broad, those nearest the cirrus are shorter and less acuminate. *Male spadix*.........*Fruiting spadix* nodding, rather slender and diffuse, 35 cm. long (in one specimen), supported by a slender, slightly flattened, peduncular part of the same breadth throughout and armed all round with irregular whorls of black spiculae and flat confluent spines ; primary spathes deciduous, not seen by me ; axial part of the spadix covered with a very thin adherent rusty-brown indumentum ; the main axis is rather slender, slightly flattened and bears a few erecto-patent partial inflorescences (3 in one specimen) ; these have a distinct axillary callus, are 8–10 cm. long, and carry 3–4 spikelets on each side ; their axis is slightly sinuous and acutely trigonous ; spikelets spreading, or almost horizontal, with a distinct axillary callus ; the largest are about 3 cm. long and have 3–4 subregularly set bifarious flowers on each side ; their axis is sinuous, rather slender and trigonous ; spathels very shortly annular, extended at one side into a short, broad, triangular, acute point ; involucrophorum shortly pedicelliform, obconical, subtrigonous, tapering towards the base, about 2 mm. long, spreading, callous at its axilla, truncate at the upper end and almost without a limb ; involucre quite on a level with the involucrophorum, flat, discoid, orbicular, also without a distinct limb ; areola of the neuter flower inconspicuous. *Fruiting perianth* very broadly obconical, very shortly pedicelliform. *Fruit* spherical, 14–15 mm. in diameter; very shortly umbonate-mammillate ; scales in 15 longitudinal series, sharply and narrowly channelled along the middle, regularly rhomboidal, of a uniform hazel-nut-brown colour, with slightly paler, almost entire, very acute margin, the point sometimes slightly produced but always obtuse. *Seed* somewhat irregularly globular, minutely tubercled, about 1 cm. in diam. ; embryo basal.

HABITAT—The Malayan Peninsula at Larut in the district of Perak in open jungle on the top of the mountains between 1200–1900 m. elevation, *King's collector*, (No. 4129 in Herb. Calcutt.). Also in Borneo on the summit of Mount Poe at 1,300 m. elevation, *Foxworthy*, May 1908 (No. 222 in Herb. Manilla).

OBSERVATIONS—It is extremely like *D. Kunstlerii*, but that is an erect not a climbing species. See observations on *D. Kunstlerii*. The specimen collected by Foxworthy in Borneo, on the summit of Mount Poe, agrees fairly well with the type of *D. vagans* of the Calcutta Herbarium, only it is more slender, the sheathed stem being only 12 mm. in diameter. It has however the same kind of spinescence. The single leaf present has the leaflets somewhat inequidistant and shagreened even more than in the type, by the innumerable small and short transverse veinlets. The fruit is spherical, 15–16 mm. in diameter, with the scales of a uniform cinnamon-brown colour.

PLATE 62.—Daemonorops vagans *Becc.* Upper end of a leaf (under surface); upper portion of a leaf-sheath with the base of a petiole and an entire fruiting spadix. From No. 4129 in Herb. Calcutt.

59. DAEMONOROPS DEPRESSIUSCULUS Becc. in Rec. Bot. Surv. Ind. ii, 226.

Calamus depressiusculus Teijsm. and Binn. in Cat. Hort. Bog. (1886), 74 (name only).

Calamus (Sect. *Daemonorops*) *depressiusculus* Miq. de Palmis, 29 (name only); H. Wendl. in Kerch. Palm. 236.

DESCRIPTION.—Scandent, of moderate or even rather large size. *Sheathed stem* 4 cm. in diameter. *Leaf-sheaths* gibbous above, densely armed with thin, laminar, very unequal spines, of which the largest are 3–4 mm. broad at the base and 2–3 cm. long, while the smaller are needle-like or spiculiform, and disposed in interrupted transverse approximate series; the mouth is armed with straight erect spines, narrower and considerably longer than the larger ones on the body (10–15 cm. long, and 2–4 mm. broad at their base); the surface of the young sheaths and also the spines, especially on their edges, are covered with a dense rusty-furfuraceous scurf. *Leaves* large, 1·8 m. long in the pinniferous part, and terminating in a long and rather robust cirrus; the petiole is long and robust, 50–55 cm. long, equally convex on both surfaces and with very obtuse edges that are armed throughout with straight, horizontal, not very long spines; underneath the petiole is almost smooth or with a line of straight spines along the centre near the base; its upper surface is smooth or has a few scattered prickles; the rachis in its first portion is convex above, smooth throughout and has a rather broad groove on each side for the insertion of the leaflets, higher up the salient angle becomes gradually more acute, and assumes flat side-faces; underneath the rachis is, at first, armed with solitary and then 3-nate and 5-nate claws, which on the cirrus at very regular intervals become half-whorled; leaflets very numerous, in one leaf 90 in all, equidistant (3–5 cm. apart) except towards the upper end, linear-ensiform, broadest below the middle, tapering thence towards the base, and gradually acuminate above to a subulate, slightly bristly tip, papyraceous, rigidulous, green and concolorous on both surfaces, 3-costulate; the mid-costa is slightly bristly spinulous above, but only near the apex; the side costulae are bristly from the middle upwards; on the lower surface the mid-costa only is sparingly bristly; transverse veinlets very minute and approximate; margins very minutely and appressedly spinulous; the intermediate leaflets are 35–38 cm. long, 18–20 mm. broad; the lower are narrower; those towards the apex becoming gradually smaller. *Male spadix* before flowering rigid, erect, slender, cylindraceous, as thick as a man's finger, usually 40–50 cm.—in vigorous plants as much as 80 cm.—long; primary spathes at first tubular and narrowly cornet-shaped, at the upper end obliquely truncate and shortly and obtusely bidentate, each spathe projecting considerably beyond the one immediately below; after the anthesis the outermost persists and is flat or slightly concave (at least in its upper part), is spathulate-cuneiform, and gradually narrows from near the upper end towards the base, internally it is glabrous and polished, externally grey and rusty-furfuraceous, armed more or less on the back, and especially near the base, or at least on its two very obsolete keels, with solitary or fascicled, spreading, often shortly seriate, blackish spiculae; inner spathes smaller, deciduous, slightly spinulous along the dorsum but quite smooth in the cultivated plant; the pedicellar part of the spadix is rather short, armed with fascicled, subverticillate, spreading, needle-like spines; the flowering panicle is strict or very slenderly cupressiform; all the axial parts are covered with a rusty-furfuraceous indumentum; the main axis is subterete in its lower part, irregularly angular higher up, and bears 8–10 partial inflorescences which are much branched, appressed to the main axis, 10–12 cm. long, and cupressiform on the whole; secondary spathes scale like, scarious, extended at one side into a broad triangular point; the branchlets have 8–9 spikelets on each side, which are bifariously set, but all turned outwards-the lower spikelets are the largest, 1 cm. long, and have 8–10 sub-unilaterally set; flowers in all, the others successively shorter, and with fewer flowers; their axes are filiform, angular, indented at the insertion of each flower; spathes very small, very shortly produced at one side into a small rounded limb; the involucre has no distinct limb and is reduced to a circular rim. *Male flowers* oblong, obtuse, very small, 3–3·5 mm. in length; the calyx very small and short, divided almost down to the base into 3 small triangular acute teeth; petals oblong, strongly striately veined. *Female spadix* not seen entire by me; female spikelets 4 cm. long with comparatively numerous, approximate, bifarious flowers (7-8 on each side); the axes rather slender, sinuous, acutely 3-gonous and covered with a thin adherent rusty-brown indumentum; spathels very shortly annular, slightly produced at one side into a small triangular point; involucrophorum pedicelliform, short and thick, about 1 mm. long, with a distinct axillary callus, and without a distinct limb; involucre almost on a level with the involucrophorum, discoid, orbicular, slightly-convex, also without a distinct limb; areola of the neuter flower very small, punctiform. *Fruiting perianth* almost flat. *Fruit* rather small, globular-depressed, mucronate-umbonate in the centre, 12-13 mm. in diam; scales arranged in 18 longitudinal series, rhomboidal, almost as broad as long, narrowly grooved along the centre, straw-coloured especially in the central part but reddish at the edges, their point not produced, obtuse, the margins entire very narrowly scarious. *Seed* conspicuously depressed, subreniform, minutely pitted, slightly and almost equally convex on both surfaces, 10 mm. long, 8·5 mm. broad, 6 mm. high, very deeply ruminated; the chalazal fovea small, pit-like, narrow and deep, situated on the raphal side not far above the base; embryo almost central on one of the surfaces.

HABITAT.—Sumatra. The type specimen was collected in Sumatra by *Teijsmann*, but the exact locality is not known. I consider as belonging to *D. depressiusculus*, a fruiting spadix collected in the forests near Mount Sibajak, in the Battak country, Residency of Deli in W. Sumatra, and sent by Mr. Vriens to Professor Martelli in 1905.

OBSERVATIONS.—I have received the fruits of the true *Calamus depressiusculus* Teijsm. et Binn. from the Herbarium of Utrecht; these I have described, and upon these the species is established. But I have described the male plant from that cultivated at Buitenzorg under the name of *Calamus depressiusculus*, which is almost certainly derived from seeds of the same gathering as the fruits mentioned above.

In the specimen from Mount Sibajak the fruits are not so plainly depressed and are longer pedicelled, being borne on an involucrophorum 2–3 mm. long; also the seed is not so conspicuously flattened.

D. depressiusculus is very closly related to *D. Riedelianus* and *D. Gaudichaudii*, but distinguishable by its smaller fruit and the more flattened seed.

PLATE 63.—Daemonorops depressiusculus *Becc.* Lower portion of a male spadix before flowering; male spadix in flower; upper portion of a leaf-sheath and base of the petiole; intermediate portion of a leaf (upper surface). From a plant cultivated at Buitenzorg (Herb. Beccari). A spikelet with mature fruits and one seed, from the type specimen in the Herbarium at Utrecht.

60. DAEMONOROPS GAUDICHAUDII Mart. Hist. Nat. Palm. iii, 331; Walp. Ann. iii, 481 and v, 829; Becc. in Rec. Bot. Surv. Ind. ii, 226, and in Perkins, Fragm. Fl. Philipp. i, 47, and in Webbia. i. 365, and in Philip. Journ. of Science, iii, 342.

Calamus Gaudichaudii H. Wendl. in Kerch. Palm. 236.

Daemonorops fuscus Mart. Hist. Nat Palm. iii, 331; Walp. Ann. iii, 481 and 829.

Calamus usitatus Blanco, Fl. de Filip. 1st edit. (1837) 265 and Gran. Edic. i, 330; Kunth, Enum. Plant. iii, 595.; Mart. Hist. Nat. Palm. iii, 340; Walp. Ann. iii, 490 and v, 831; Miq. Fl. Ind. Bat. iii, 131.

DESCRIPTION.—Scandent. *Sheathed stem* 2–4·5 cm. in diameter. *Leaf-sheaths* gibbous above, more or less rusty-furfuraceous when young, armed with variable but usually thin, laminar, approximate, more or less seriate, rather long, blackish, spreading or deflexed spines; at times the spines are confluent by their bases, and several of them are spiculiform; at the mouth the spines are as much as 7–8 cm. in length and erect. *Leaves* large, 1·5–2 m. long in the pinniferous part; petiole about 20–40 cm. long, more or less spinous on the edges, flattish or slightly concave on the lowest part of its upper surface, where it is usually more or less covered with erect prickles. Leaflets very numerous, equidistant, closely set, linear or linear-ensiform, broadest below the middle, thence tapering towards the base, and gradually acuminate upwards to a subulate bristly tip, papyraceous, green and concolorous on both surfaces, 3-costulate; on the upper surface the mid-costa is somewhat bristly-spinulous near the apex, the side costae bristly from the middle upwards at least; on the lower surface the mid-costa alone is rather closely bristly; margins closely spinulous; transverse veinlets rather numerous, and almost equally distinct on both surfaces; the medial leaflets are 35–45 cm. long, and 15–25 mm. broad. *Male spadix* very similar to that of *D. oblongus* and allied species, about

40 cm. long (including a pedicellar part about 6 cm. in length,) and armed with black, needle-like spines; the flowering panicle very slender and strict, its main axis subterete and as thick as a pack-thread; partial inflorescences about 6, appressed to the main axis, narrowly fastigiate-cupressiform, 6–7 cm. long, and formed by 8–10 branchlets; secondary spathes very small, scale-like, extended at one side into an erect, triangular, acute point; the branchlets have 8–10 spikelets that are fastigiate and gradually shorten; the lowest spikelets are the largest, 7–8 mm. long and have 4–5 unilaterally set flowers in all; the other spikelets are gradually shorter and have fewer flowers; their axis is very slender, filiform, indented at the insertion of each flower; spathels very small, extended at one side into a small, amplectent, subinfundibuliform triangular, acute point; involucre formed by two very small, triangular, acute, opposite, scale-like bracts. *Female spadix* strict, paniculate-cupressiform when in flower, nodding or recurved when in fruit, 40–70 cm. long including the peduncular part (that not covered by the outermost spathe) which is rather slender, very variable in length (6–20 cm.), densely armed with very slender, elastic, needle-like, black spines, which are more or less grouped on a callous base; primary spathes deciduous, the outermost more persistent than the others, slightly concave-cymbiform, narrowly lanceolate, gradually and almost equally attenuate towards both ends, coriaceous, polished, striate and of a cinnamon colour inside, externally obsoletely two-keeled and armed with long, black, subulate, elastic, usually solitary spines which rest on a pale bulbous base; the axis and branches are covered with a thin removable rusty-furfuraceous indumentum; the partial inflorescences are 5–8, erect and appressed to the main axis; the lower have 4–6 distichous spikelets on each side; the upper are somewhat shorter and have fewer spikelets; secondary spathes very small, consisting of a short, membranous, entire and, at one side, acute ring; spikelets in the fruiting spadix inserted at an angle of 45°, with a distinct axillary callus; the lower spikelets of each inflorescence are 3–5 cm. long, and have 5–6 bifarious flowers on each side; the upper are somewhat shorter and have fewer flowers; spathels very small, scale-like, amplectent, extended at one side into a small broad triangular point; involucrophorum callous at its axilla, thick, obsoletely angular, spreading, slightly obconical, 3–4 mm. long; involucre shortly pedicelled or at least slightly protruding beyond the involucrophorum, disciform above and bordered by a very narrow, annular ring; areola of the neuter flower concave, niche-like, with a punctiform, non-swollen scar. *Fruiting perianth* explanate. *Female flowers* 7 mm. long, narrowly trigonous-pyramidate, acuminate, calyx small, shortly cupular, 2 mm. long, truncate, margin very shallowly 3-toothed, furfuraceous; corolla strongly striately-veined, divided down past the middle into 3 triangular, lanceolate segments, about 4 times as long as the calyx. *Fruit* (when quite mature) globular, frequently more or less depressed, very shortly mucronate-mammillate, 15–17 mm. in diameter; scales arranged in 15 longitudinal series, shining, convex, narrowly and deeply grooved along the centre, greenish-brown when fresh (have apparently become darker with time in the herbaria), with a narrow scarious, slightly rubiginous and very appressed margin, and an obtuse tip. *Seed* minutely tubercled, subglobular, somewhat depressed, length and breadth the same, 10–14 mm. and about 8 mm. through, flattish or slightly gibbous, or even at times subcarinate on the raphal side, which is marked about the centre with the chalazal fovea represented by a short and narrow opening penetrating rather deeply into the albumen; albumen deeply ruminated; embryo situated almost in the centre of the

side opposite to the raphe, and therefore in opposition to the chalazal fovea and not at the base of the seed.

HABITAT.—The Philippines, where it is apparently a common plant. It was first collected at Manilla by *Gaudichaud* in November 1836 (Herb. Paris.) and afterwards by many others. In Luzon: Unisan, Province of Tayabas (*Vidal* No. 932 in Herb. Kew. and No. 4063 in Herb. Beccari); Cardona, District of Moron (*Vidal* No. 1941 in Herb. Kew.): in Antipolo, Province of Rizal (*Merrill* No. 1641); Dinalupihan, Province of Bootaan (*Merrill* No. 1669 in Herb. Berol.); Lamao River, Mt. Mariveles (*Whitford* No. 289 in Herb. Manill.); Sampalos (*Warburg* No. 367 in Herb. Berol.)—in this specimen the fruit often contains two piano-convex seeds; Camiguin Island of the Babuyanes group, (*E. Fenix* No. 4066, Herb. Manill.); Mindanao, Province of Surigao, (*T. H. Bolster* No. 353, Herb. Manill.); Mindoro: (*M. L. Merrill* Jan. 1907, No. 6218 and *Whitford*, Herb. Manill. No. 1371); Bongabong River, (*M. L. Merrill*, March 1906, No. 3741, Herb. Manill.); Calapan (*L. Mangubat*, June 1906, No. 948 Herb. Manill.).

OBSERVATIONS.—I have reduced *Calamus usitatus* of Blanco to *Daemonorops Gaudichaudii* more by exclusion than by the vague characters assigned to it by that author. In fact I consider *C. usitatus* to be a *Daemonorops* chiefly by reason of the character Blanco gives of its calyx "persistente de seis piezas, las tres exteriores mas grandes." No doubt that by "calyx" Blanco really means the perianth and the assertion that the 3 "external" parts of it are larger than the internal may be a slip for the reverse. Now there are no *Calami* that have the corolla of the female flowers much larger than the calyx. The globular and apparently large fruit (as it is said that the involucre of its seed is edible) and its frequency near Manilla, whence no other species of *Daemonorops* is known, are the reasons which have induced me to identify *C. usitatus* with *D. Gaudichaudii*.

D. Gaudichaudii and *D. fuscus* certainly represent the same species, for this latter name has been assigned to the specimens bearing mature fruit, while the same plant having the spadices charged with ovaries only in course of development has been named *D. Gaudichaudii*. I have seen in the Paris Herbarium the type specimen of *D. fuscus*, consisting of a male spadix without the spathes, and another spadix which still retains 2–3 mature fruits in bad condition; these specimens bear the label "Voyage de M. Gaudichaud sur la Bonite, 1836-37–Manile, Novembre 1836". On the same sheet, without a special label is fastened the typical form of *D. Gaudichaudii*, on one side of which Martius has written "sit, ut nomen habeat: *D. Gaudichaudii*".

Another specimen of a female spadix in flower of *D. fuscus* has also a label like that of *D. Gaudichaudii*, and Martius has written upon it "*Daemonorops* e serie Cymbospatharum" and then "v. Solenospatharum"; this has been crossed out, and "orthostichæ 17–18. Sit *D. fuscus* Mart.! Cal. quam cor. 4-plo brevior" substituted.

Vidal's No. 4063, offers a proof of the conspecificity of *D. fuscus* and *D. Gaudichaudii*, as one branch, with very young fruit, corresponds to the latter, and another, with mature fruit, to the former.

D. Gaudichaudii is closely related to *D. Riedelianus*, a Celebes species.

D. Gaudichaudii is a rather variable plant as to its size, degree of spinescence of its leaf-sheaths, dimensions of its leaflets, and shows also small variations in fruit and seed.

In the specimens from Luzon the sheathed stem is usually 2–3 cm. in diameter; the fruit is usually 15–16 mm. in diameter, and the seed flattish, or slightly gibbous on the raphal side.

The specimens from Mindoro somewhat differ from those from Luzon. In Merrill's No. 3741 from the Bongabong River, the sheathed stem is 4 cm. in diameter, and the fruits are 17-18 mm. in diameter and, when quite ripe, somewhat depressed.

In the specimens from Calapan (also from Mindoro, *Mangubat* No. 918) the sheathed stem is 4–5 cm. in diameter; the leaflets are 22–25 mm. broad and have some long bristles on two nerves on the undersurface. The fruits are 18–19 mm. in diameter, conspicuously depressed, with the scales of a lighter straw-colour than usual, and tinged with reddish-brown at the point.

Merrill's No. 6218, also from Mindoro, has the sheathed stem 4 cm. and the fruits 15–16 mm. in diameter; the collector's note says: "very common; the non-commercial variety of Bejuco".

Whitford's No. 1371 (Mindoro) has the fruits about 15 mm. in diameter, somewhat depressed, and the seed 11 mm. broad with the raphal side distinctly carinate at its base. Bolster's No. 353 from Mindanao is very similar to the specimens from Luzon; of it the collector notes that it is high-scandent, and used for binding.

Plate 64.—Daemonorops Gaudichaudii *Mart.* An intermediate portion of a leaf (under surface); a very small portion of the same leaf (under surface); an entire fruiting spadix; all from Merrill's No. 868 in Herb. Berol. An entire spadix with the outer spathe *in situ* and with very young fruits, from Loher's No. 1363 in Herb. Kew.

61. Daemonorops ochrolepis Becc. in Perkins, Fragm. Fl. Philipp. i, 47, and in Webbia i, 356.

Description.—Apparently scandent and rather large. *Leaf-sheaths* about 5 cm. in diameter, copiously armed with interrupted, approximate series of dark-brown or spadiceous, pectinate, rigid bristles. *Ocrea* short, liguliform, densely bristly, hispid. *Leaves* large; petiole biconvex, rather short, 16–18 mm. broad, smooth on both surfaces, armed with small, fascicled and divergent prickles on the rather acute edges; rachis armed beneath towards its upper end first with solitary, then 3-nate, and higher up 5-nate claws, bifaced on the upper surface, the salient angle acute and smooth; leaflets numerous, equidistant, usually 5–6 cm. apart, ensiform-lanceolate, tapering rather suddenly to their base, where strongly bent backwards, gradually acuminate above to a filamentose tip, marked with a rather distinct indentation on the lower margin near the apex, 35–40 cm. long, 3–3·5 cm. broad, papyraceous, rather firm, green, concolorous and almost glossy on both surfaces; their mid-costa on the upper surface acute and smooth, or minutely spinulous near the apex, on the lower sparsely bristly from the middle upwards; secondary nerves glabrous on both surfaces: two, on each side of the mid-costa, are rather distinct above, but are not strong enough to give the leaflets an appearance of being 5-costulate; transverse veinlets rather conspicuous, very numerous and approximate; margins closely and appressedly spinulous, the lower slightly thickened and marked with a very narrow polished band. *Male spadix*...... *Female spadix* strict when in flower, in one specimen 75 cm. long and with 7 partial inflorescences; the peduncular part curved, 15 cm. long, very densely armed with spadiceous, shortly seriate, rigid bristles or spiculae; primary spathes deciduous; the outermost more persistent and much shorter than the inner, coriaceous, opening almost flat during the anthesis, oblong-spathulate, gradually tapering from near the upper end towards the base; the upper margin truncate-undulate and bristly ciliate, shining and of a cinnamon-brown colour internally, two-keeled externally, and armed, especially on the keels, with tufts of the usual bristles or spiculae; partial inflorescences short, 10–12 cm. long, erect, appressed to the main axis, with 5–6 pinnately set, gradually diminishing spikelets on each side; secondary spathes very short, annular, prolonged at one side into a scale-like triangular, acuminate point; spikelets rigid, when bearing fruit diverging at an angle of 45°, with a distinct axillary callus; the lower spikelets of each inflorescence are about 5 mm. long and bear 2 slightly assurgent series of 6–7 flowers each; the upper spikelets shorter, flowers fewer, spathels similar to the secondary spathes, but smaller; involucrophorum thick, 2–3 mm. long, angular-obconical; involucre slightly raised above the involucrophorum, truncate, flat at its upper end, and with an inconspicuous annular limb; areola of the neuter flower niche-like, not very deep, the scar of the fallen flower horizontal and not swollen, the flower apparently erect. *Female flowers* conically elongate-acuminate, 8 mm. long; calyx shallow, cupular, very slightly 3-denticulate; corolla considerably longer than the calyx, urceolate in its basal part, parted for two-thirds of its length into 3 lanceolate, undulate, acuminate segments. *Fruiting perianth* ....*Fruit* spherical, very briefly and broadly conical-beaked, or mammillate, when quite mature 20 mm. in diameter; scales in 15 longitudinal series, of a very light straw-colour, convex, shining, narrowly grooved along the centre, the margine slightly darker, erosely-toothed. *Seed* somewhat irregularly globular, slightly ventricose on the raphal side, 14–15 mm. in diameter, very minutely tubercled and pitted; the chalazal fovea punctiform, superficial, almost obsolete; albumen ruminated with very narrow and numerous channels; embryo basal.

HABITAT.—The Philippines: Guinayangan, Province Tayabas in Luzon, *Merrill* (No. 2069 in Herb. Manill. and Berol.); Central Luzon, *Loher* (No. 1365 in Herb. Kew.)

OBSERVATIONS.—Apparently related to *D. Calapparius*, from which it differs in its much broader leaflets which are bristly only underneath on the mid-costa; the fruit of *D. ochrolepis* is slightly smaller than that of *D. Calapparius*, otherwise very similar, but the seed in the latter has a very deep chalazal fovea, while in the former it is almost obsolete. In Loher's specimens the fruit is quite mature, and 20 mm. in diameter, but in those of Merrill it is only 17–18 mm., being younger.

PLATE 65.—Daemonorops ochrolepis *Becc.* Upper portion of a leaf-sheath with the lower portion of a female spadix in flower; an entire fruiting spadix; intermediate portion of a leaf (under surface). From Merrill's No. 2069 in Herb. Manill.

DAEMONOROPS OCHROLEPIS var. RADULOSUS Becc.

DESCRIPTION.—Rather robust. *Sheathed stem* about 4 cm. in diameter, copiously armed with interrupted, approximate, oblique series of pectinate, very slender, rigid bristles, which are united by their bases into very narrow, membranous, interrupted crests. *Ocrea* very short, liguliform, apparently bristly. *Leaves* large; petiole about 18 cm. long, 2 cm. broad, flat on the upper surface, convex on the back, and like the lower portion of the rachis (which is flattened and biconvex) covered on both surfaces, but especially on the upper, with very small, but robust, almost uniform ascendent spines; in its upper portion the rachis is convex, bifaced above and has the salient angle spinulous; leaflets as in the typical form, the largest as much as 50 cm. long and 35–38 mm. broad. The portions of fruiting spadix seen by me do not differ from the corresponding parts of the typical form. *Fruit* spherical, very shortly and conical-beaked, only 18 mm. in diameter, but it is not quite mature.

HABITAT.—The Philippines: Tayabas Province, Luzon, *H. M. Curran*, March 1908. To this same variety I refer a fruiting specimen collected in Mindanao, Camp Keithley, Lake Lanao, by *Mrs. Mary Strong Clemens*, Jan. 1907, No. 898. (In this specimen the fruits are globose-ovoid, only 15 mm. in diameter, but they are very immature.)

OBSERVATIONS.—This variety differs from the type, in the petiole and lower portion of the rachis not being smooth, but densely prickly on both surfaces; also in the salient angle of the rachis being spinulous throughout to the very end of the pinniferous part.

To the variety *radulosus* of *D. ochrolepis* apparently belongs a specimen with male spadices which was collected by *Loher* at Siya bandoc (Province Rizal), Philippines, June 1905 (No. 7078 in Herb. Kew.) Of this I subjoin a description.

The sheathed stem is about 3 cm. in diameter. *Leaf-sheaths* armed with several oblique series of pectinate slender spines, which are darker, stronger, and longer than in Clemens's specimens No. 898 from Mindanao; petiole strongly prickly on its upper surface; salient angle of the rachis spinulous; leaflets as in the type. *Male spadix* erect, elongate, before flowering very narrow and terete, 1–1·1 m. long, 1 cm. in diameter, composed of 9–10 partial inflorescences and an equal number of primary spathes; during the anthesis the panicle is strict and very narrow; pedicellar part rather elongate, rather densely armed with ascendent, straight, spiculiform spines; primary spathes before flowering cylindrical, covered externally with a very adherent, thin, brown-furfuraceous indumentum; internally they are polished, striate and of a cinnamon-brown colour; their mouth truncate and fringed or ciliate with rigid, blackish, bristle-like spiculae; the outermost spathe covers only the base of the next within, is armed with scattered spiculae externally, acutely keeled on the back, and terminating in a broadly triangular point: when spread out (after the anthesis) elongate-cuneiform; the second and the third inner spathes are sparingly bristly-spinulous, and also cuneate (when open); the succeeding ones are smooth, broadly linear and terminate in a deltoid bristly point; the axial part of the spadix is slender, rusty-furfuraceous; partial inflorescences 8–12 cm. long, much branched; spikelets, very slender, angular, with several sub-unilateral flowers; each flower is supported by a small, scale-like, acute bract (spathel) within which it is furnished with a rudimentary involucre. *Male flowers* lanceolate, acuminate, irregular and asymmetric from mutual pressure; the calyx very small, and short, trigonous, 3-dentate; the petals striate, 6–7 times as long as the calyx.

Plate 66.—Dæmonorops ochrolepis *var.* radulosus *Becc.* An intermediate portion of a leaf (upper surface); portion of the sheathed stem with a male spadix before flowering in situ; an entire male spadix in flower. From Loher's No. 7078 in Herb. Kew.

62. Daemonorops Clemensianus Becc. sp. n.

Description.—Apparently scandent and of moderate size. *Sheathed stem* about 2 cm. in diam. *Leaf-sheaths* copiously armed with scattered, or shortly seriate, blackish, stiff, very narrowly laminar, sub-bristly spines; the mouth armed with numerous, closely imbricate, black, very long, (8–12 mm. long, 2–4 mm. broad) erect, rigid, laminar spines. *Leaves* elongate, 1·3 m. or more long in the pinniferous part, and terminating in a rather robust clawed cirrus; petiole about 25 cm. long, very slightly flattened, equally biconvex, armed all round with light-coloured spines, of which those at the edges near the base are about 2 cm. long, straight and ascendent, the others unequal, short, straight, sub-horizontal; rachis for about half way up biconvex, smooth above, but armed below along the centre and even on each side with small, solitary, light-coloured claws; towards the apex the rachis is bifaced above with an acute smooth salient angle, and is armed beneath with first 3-nate, and then 5-nate red-tipped claws. Leaflets numerous, equidistant or nearly so, not very closely set (2·5–3·5 cm. apart on each side) elongate and narrow, linear-ensiform tapering from below the middle to a rather acute base, gradually acuminate upwards to an elongate and slender bristly tip, dull on both surfaces, rather thinly papyraceous, spinulous above upon the mid-costa and one slender nerve on each side of it; underneath furnished with rather long bristles on the mid-costa only; transverse veinlets not very sharp; margins appressedly spinulous; the intermediate leaflets 40–42 cm. long, 13–15 mm. broad. *Male spadix* erect, nodding, 50–60 cm. long, carried on a densely spiculiferous, 6–10 cm. long pedicellar part; before flowering cylindraceous, slender, about 1 cm. in diam.; the spathes protrude as usual, each gradually beyond the one immediately below, and all are prolonged at the upper end into a triangular, more or less bristly or spiculiferous point; the outermost is armed more or less with stiff, elongate, often fascicled spiculae. *Male flowers* lanceolate, not very acute, about 4 mm. long; the calyx very shortly cyathiform, 3-toothed; corolla about 5 times as long as the calyx. *Female spadix* rigid, not very elongate, with several rather approximate partial inflorescences, its pedicellar part densely covered with stiff spiculae, which are usually united by their indurated and rather swollen bases; partial inflorescences

10–15 cm. long, erect, appressed to the main axis, with 4–5 pinnately set, gradually diminishing spikelets on each side; secondary spathes very short, annular, prolonged at one side into a scale-like, triangular, acuminate point; spikelets rigid, rather thick, with their axes acutely trigonous and when bearing fruit diverging at an angle of 45° and with a distinct axillary callus; the lower spikelets of each inflorescence 5–7 cm. long, with 2 series of 7–8 slightly assurgent flowers; the upper spikelets somewhat shorter, flowers fewer; involucrophorum thick, 3–4 mm. long, angular, obconic; involucre appearing like a short prolongation of the involucrophorum and terminating in a discoid flat surface; areola of the neuter flower niche-like, rather deep, flower scar horizontal and not swollen. *Fruiting perianth* very shortly pedicelliform. *Fruit* comparatively very large, spherical, very shortly and broadly conical-beaked or mammillate, 22–24 mm. in diameter (when perfectly mature); scales arranged in 18 longitudinal series, very narrowly and sharply grooved along the centre, of a uniform light straw-colour, convex, shining, with a very narrow, slightly discoloured, erosely-toothed margin; tips not produced, obtuse. *Seed* somewhat irregularly globular, 16 mm. in diam. slightly ventricose on the raphal side, very minutely tubercled and pitted, strongly ruminate with very narrow and numerous channels; the chalaza punctiform, superficial, inconspicuous.

HABITAT.—The Philippines: Camp Keithley, Lake Lanao, Mindanao, *Mary Strong Clemens* September-October 1907, (No. 1227, Herb. Bureau of Science, Manila).

OBSERVATIONS.—Related to *D. ochrolepis*, but distinguishable by its very narrowly ensiform leaflets and larger fruit. The fruit of *D. Clemensianus* is about the size of that of *D. Calapparius* and is one of the largest in the genus.

PLATE 67.—Daemonorops Clemensianus *Becc.*—Intermediate portion of a leaf (upper surface); lower and intermediate portion of a spadix with mature fruits; upper portion of a leaf-sheath with the base of a petiole and an entire male spadix in flower; one seed entire and another longitudinally cut through the embryo. From Clemens's No. 1297 in Herb. Manilla and Beccari.

63. **DAEMONOROPS CALAPPARIUS** Bl. Rumphia, iii, 7; Mart. Hist. Nat. Palm. iii, 331; Walp. Ann. iii, 481 and v, 829; Miq. Fl. Ind. Bat. iii, 103; Becc. Malesia i, 88.

Calamus Calapparius Mart. l. c. 209, 1st edit.; Griff. in Calc. Journ. Nat. Hist. v, 44 and 45; Miq. De Palm. Arc. Ind. 21, and 29; H. Wendl. in Kerch. Palm. 235 (excl. *C. petraeus* Lour.); Kunth, Enum. Pl. iii, 208.
Calamus (sect. *Daemonorops*) *amboinensis* Miq. De Palm. Arc. Ind. 20 and 28; H. Wendl. in Kerch. Palm. 235; Becc. Malesia, i, 88.

Palmijuncus Calapparius Rumph. Herb. Amb. v, 98, pl. 51; Martelli, Le Collez. di G. E. Rumph, 163.

DESCRIPTION.—Very large and high scandent. *Sheathed stem* at times as thick as the arm. *Leaf-sheaths* densely covered with slender, short, needle-like spines, the mouth truncate and armed with spines not longer than those on the sheath. *Leaves* large, cirriferous, about 2·5 m. long in the pinniferous part; petiole robust, about 15 mm. broad, convex and almost smooth beneath, flattish on the upper surface where covered with numerous, short, conical, black-tipped prickles; the edges acute and prickly; the rachis, in its lower portion is, like the petiole, prickly on the upper surface with a furrow on each side for the insertion of the leaflets, and higher up is bifaced with a very acute, not prickly, salient angle; on the under surface, the rachis is armed but not very densely with claws at first solitary, then ternate and on the cirrus 5-nate and half-whorled; leaflets very numerous, rather closely set, equidistant, firmly papyraceous, green, very slightly paler beneath, linear-ensiform, tapering very slightly towards the base where they bend very suddenly backwards, very gradually acuminate towards the apex, 3-costulate with a rather slender mid-costa and one strong secondary nerve on each side of it, which with the mid-costa beneath are furnished with several 1 cm. long, very fine, spreading, spadiceous bristles; transverse veinlets rather sharp, not very crowded, translucent; margins, finely and rather closely spinulous; the largest leaflets (the intermediate) 35–40 cm. long and 15 mm. broad; those nearer to the petiole are narrower and shorter, those towards the upper end remote, and rudimentary. *Male spadix*...... *Female spadix* rigid, rather short, about 40 cm. long, in one (incomplete ?) specimen, (2–2·5 feet according to Rumph), with but few partial inflorescences; the peduncular part armed like the sheaths (Rumph); the largest partial inflorescences (in the specimen seen by me) about 12 cm. long, and carry distichously 5–6 spikelets on each side; spikelets rigid 7–8 cm. long (or at times 10–12 ?) with 5–8 bifarious flowers on each side; their axes rusty-furfuraceous, very minutely and densely scabrid, sinuous, and irregularly angular; spathels represented by a very narrow scarious ring, very shortly apiculate at one side; involucrophorum rather thick, 3–5 mm. long, obconical, obsoletely angular, spreading, with a narrow base, distinctly callous with a transverse fovea at its axilla, broader at its upper end but without a distinct limit; involucre very short, slightly surpassing the involucrophorum and terminating in a broad, flat, orbicular surface, which is bordered by a very narrow annular margin; areola of the neuter flower concave, niche-like, broader than high, the scar punctiform, not swollen. *Fruiting perianth* explanate. *Fruit* comparatively large, spherical, very shortly and suddenly beaked, 23–24 mm. in diameter; scales very narrowly and neatly grooved along the centre, regularly rhomboidal, glossy, of a uniform light-brown colour with a very narrow lighter scarious margin, the tips obtuse. *Seed* globular, coarsely pitted, 14 mm. in diameter, ruminated almost to the centre with numerous very narrow channels, filled with a very dark stuff; embryo basal, penetrating almost to the centre of the albumen; chalazal fovea sub-apical, narrow, circular, deep, obliquely penetrating quite to the centre of the seed, and almost opposite to the embryo.

HABITAT.—Amboina on the mountains at Hitoo according to Rumph, who gives the following vernacular names for it: Malayan name "Rotang Calappa" on account of its apical bud or "cabbage," which is eatable like that of the "Calappa tree" (*Cocos nucifera*): Amboinese names "Ua Hahulu" or the "Hairy Rotang," and also "Ua Niwel"—the "niwel" is the "Cocoa tree—" and also "Ua mamina" for its juice is said to be similar to that of the "Mamina tree" (*Carumbium amboinicum* Miq.). The Rotang is useless.

D. Calapparius has been rediscovered in Amboina by *Hombron* (Herb. Mus. Paris) and more recently by *De Vriese* (Herb. Leyd.).

OBSERVATIONS.—Hombron collected this species during the voyage of the "Astrolabe" and "Zelée," between the years 1838–40. Hombron's specimen consists of only an apical portion of a very young leaf and of one fruit. The latter is somewhat larger than that described above, but otherwise identical; it is as much as 28 mm. in diameter and its seed is 20 mm. thick with the chalazal fovea apical, the surface unequal, and furrowed along the raphal side.

D. Calapparius is easily distinguishable by its comparatively very large fruit, and conspicuous, pit-like, deep chalazal fovea, situated near the top of the seed, and opposite to the embryo which is basal. Generally in the seeds of *Daemonorops* the chalazal fovea is placed in the central part of the raphal side, or is obsolete.

I discovered, in the ancient collections of the Museum of Florence, a small branch of the original *Palmijuncus Calapparius* of Rumph with mature fruits, apparently the same branch which is figured in the "Herbarium Amboinense," and which was sent by Rumph himself in the year 1682 to the Grand Duke of Tuscany (see "Martelli : Le Collezioni di G. E. Rumph, p. 163). I have received from the Leyden Herbarium a portion of the type specimen of *Calamus amboinensis* Miq. which has enabled me to positively identify it with Rumph's *Palmijuncus Calapparius*.

I have derived my description from those of Rumph and Miquel, and as to the leaflets and fruit from Miquel's type specimen of *C. amboinensis* in the Leyden Herbarium, that of Rumph not being now available. *Calamus* (*Daemonorops*) *amboinensis* var. *spinosior* Miq. perhaps represents a different species from *D. Calapparius*, and probably some of the characteristics attributed to *C. amboinensis* as given in Miquel's description do not belong to it, but to the variety *spinosior*. Miquel in his description speaks of 2 spadices, one large, the other small; in the first the axial parts are glabrous, and in the second, which I have seen, these parts are furfuraceous and finely scabrid, and the fruit is perfectly spherical exactly as in Rumph's type specimen of *Palmijuncus Calapparius*.

64. DAEMONOROPS VERTICILLARIS Mart. Hist. Nat. Palm. iii, 206 (2nd edit.) and 329, pl. 175, f. iii, pl. z.xii, f. i, and pl. z.xxii, f. vi, vii; Miq. Fl. Ind. Bat. iii, 99; Walp. Ann. iii, 478 and v, 828; Hook. f. Fl. Br. Ind. vi, 470; Becc. in Rec. Bot. Surv. Ind. ii, 228; Ridley, Mat. Fl. Mal. Pen. ii, 186 (as to the female plant only).

D. periacanthus (non Mart.) Ridl. l. c. 183 (as to the male plant).

Calamus verticillaris Griff. in Calc. Journ. Nat. Hist. v, (1845) 63 and Palms Brit. Ind. 73, pl. CC. A. B. C.; H. Wendl. in Kerch. Palm. 238 (*C. verticillatus*).

DESCRIPTION.—Scandent, of either moderate or rather large size, up to 15 m. high. *Sheathed stem* 4–6 cm. in diameter. *Leaf-sheaths* armed at short intervals, often not very regularly, with several usually complete, more rarely incomplete, deflexed, spiniferous, horizontal or oblique, broad, membranous, light-coloured, deflexed collars, formed by the united bases of large, 4–6 cm. long, flat, light-coloured, often sinuous, black-tipped spines intermingled with minute, black, rigid. glossy spiculae, which fill up the spaces between them; each of these collars has another below it, as broad or at times narrower, pointing upwards but fringed only with minute spiculae; sometimes instead of a lower spiculiferous collar about as large as the upper and spinous, one much narrower or even reduced to a simple ring of spiculae united by their bases will be found; these double collars have, between the upper and lower collar of each pair, an annular hollow ant-harbouring gallery, the spaces left by the decussate spines being choked up with rubbish brought there by ants that inhabit them; the mouths of the sheaths are obliquely truncate and armed with several very long (up to 15–18 cm.) erect, straight, flat, subulate, light-coloured spines. *Ocrea* indistinct. *Leaves* large, 1·5–2 m. long in the pinniferous part, and terminating in a long, robust and at short intervals strongly-clawed cirrus; petiole elongate, 40–60 cm. long, robust, slightly flattened-biconvex, with very obtuse edges, armed densely all round, at short intervals, with more or less complete rings of very minute, confluent prickles, and on the back with comb-like series of rather large, unequal spines; rachis, in its lower portion, armed also on both surfaces with more or less interrupted and approximate series of small, pectinate, often tuberculiform prickles; on the lower surface the pectinate spines are gradually transformed into rather strong, black-tipped, digitate and still higher up into closely half-whorled claws; on the upper surface the rachis is obtusely convex in its lowest portion, and has a furrow on each side for the insertion of the leaflets and from the middle upwards is bifaced with a more or less prickly throughout salient angle; leaflets numerous, equidistant, 3–4 cm. apart, rather firmly papyraceous, almost shining, green and subconcolorous on both surfaces, narrowly lanceolate, broadest a little below the middle, thence tapering towards the base gradually acuminate towards a subulate and, at the sides, bristly tip; the mid, costa is rather strong, sharp and sparsely bristly, while the secondary nerves are slender and bald underneath; the mid-costa is rather closely bristly, and one or two secondary nerves on each side of it are sprinkled with small, spreading bristles, or quite glabrous; transverse veinlets not very conspicuous, short and interrupted; margins minutely, appressedly and not very closely spinulous; the largest leaflets usually 40–45 cm. long, and 20–23 mm. broad, but occasionally only 25 cm. by 15 mm. *Male spadix* before flowering very slender cylindraceous, acuminate, the spathes not very much protruding one above the other; during the anthesis the spadix forms a large, elongate-cupressiform, 0·8–1·2 m. long, supradecompound panicle, more or less rusty-furfuraceous in every part and supported on a very short, flattened, unarmed or at the sides slightly spinulous, peduncular part; the primary spathes spread out, are flat during the anthesis, are easily detached, thickly papyraceous, or thinly coriaceous; the outermost is not much larger than the others, is narrowly lanceolate, and long acuminate 40–45 cm. long and about 3 cm. broad, internally glabrous, striate, and of a cinnamon-brown colour, obsoletely keeled externally, where it is more or less persistently furfuraceous and densely covered with very approximate, transverse, interrupted series of innumerable, criniform, shining, black, needle-like, brittle, confluent, always ascendent spiculae; inner spathes gradually smaller, flat, not dorsally keeled and somewhat less densely spiculiferous; the internodes of the main axis are slightly flattened, have very obtuse edges, are slightly swollen at the joints, and have an axillary callus and a deep transverse fovea; partial inflorescences 10–12—not reckoning the ultimate and rudimentary—rather dense, ovate in outline, rigid, with straight or slightly flexuous axes,; the lower inflorescences are the largest, 12–15 cm. long (the others decreasing gradually in size), with a short 2–3 cm. long, plano-convex pedicellar part, and 5–7 gradually shortening, bifarious, erecto-patent branchlets on each side; the lowest branchlets are 6–7 cm. in length, bracteiform, and have 4–6 bifarious spikelets on each side; secondary and tertiary spathes bracteiform, exsuccous, brown, finely striate, with a very short tubular part, extended laterally into a broad, triangular, finely acuminate limb; spikelets 12–15 mm. long, quite flattened, 8–10 mm. broad, with 15–18 perfectly bifarious, contiguous, almost horizontal flowers on each side; their axes contracted, and the spathels very approximate or even imbricate, entire, concave-subcymbiform, and extended at one side, into a broad, rather obtuse point which subtends the flowers and protrudes beyond the involucre; the involucre is cupular, rather deep, round, runcate, entire. *Male flowers* cylindrial or slightly clavate, with a round top, 4 mm. long, and 1·5 mm. thick; the calyx tubular-campanulate, faintly striately veined, truncate, very indistinctly 3-denticulate; corolla two and half or three times as long as the calyx, parted down two-thirds of its length into 3 coriaceous, not distinctly striate, linear-oblong, concave, obtuse segments, and furnished internally at the insertion of the stamens, a little past the middle, with 6 small, but rather conspicuous, light-coloured, fleshy, tuberculiform bodies, which alternate with the bases of the filaments; the filaments are free among themselves, red-coloured, thickish, terete, subulate, with inflected apices; anthers versatile, oblong, deeply parted at the base, blunt at the apex; rudimentary ovary formed by 3 rigid, slender, erect, acute, red rods, united by their bases and reaching to about the middle of the corolla. *Female spadix* simple, decompound, rigid, erect, 1–1·5 m. long, forming a large panicle; its peduncular part is rather short (8–15 cm. long) somewhat flat, or plano-convex with rather obtuse, smooth, or very sparingly crinite edges; primary spathes as in the male spadix, deciduous; the main axis rather robust at its base, slightly swollen at the joints and bearing, at intervals of about 10 cm., several partial inflorescences; the internodes are plano-convex, have acute edges at their base, and are slightly flattened everywhere else; partial inflorescences spreading when in fruit; the lower ones 20–30 cm. long with a short (1–3 cm. long) plano-convex pedicellar part, and a distinct axillary callus; they have 5–8 spreading or almost horizontal spikelets on each side; secondary and tertiary spathes as in the male spadix; spikelets 8–12 cm. long, slender, with numerous and rather approximate flowers, (I counted from 18 to 28 on each side), their axes slightly sinuous; spathels infundibuliform, produced at one side into a membranous, reddish, broadly triangular, acuminate point, furfuraceous-tomentose on their lower part; involucrophorum embraced by its spathel, and usually shorter than its point, obconical and with a short, obliquely truncate, entire or posticously obsoletely bidentate limb; involucre usually asymmetrically cupular; areola of the neuter flower ovate or roundish, sharply defined by acute raised borders. *Female flowers* small, narrowly ovoid, 3·5–4 mm. in length; the calyx cyathiform, truncate, almost entire, or obsoletely 3-toothed, very soon split into 3 parts; the corolla about twice as long as the calyx, parted down two-thirds of its length into 3 ovate, rather acute segments; staminal urceolum united to the corolla in its lower half, and crowned by 6 triangular, rather broad, subulate, thickish teeth; anthers small, sagittate-lanceolate, obtuse, slightly shorter than the segments of the corolla; ovary globular; style obsolete; stigmata slender, subtrigonous, subulate. *Neuter flowers* small, cylindraceous, very similar to the male, but more slender and shorter (3 mm. long). *Fruit* spherical, very shortly umbonate-mucronate, small (11–12 mm. in diam.); scales arranged in 15 longitudinal series, rhomboidal, slightly broader than long, shining, grooved along the centre, first of a dirty straw-colour and finally reddish-brown with a narrow dark marginal line, the tip not produced, obtuse, the margins finely erosely-toothed. *Seed* almost symmetrically globular, very finely tubercled-scabrid and convex on the back with a very small punctiform, almost central, round chalazal fovea on the raphal side which is less convex than the other; albumen ruminate; embryo basal. *Fruiting perianth* almost entirely explanate.

HABITAT.—The Malayan Peninsula. In the interior of Malacca (*Griffith*); in the same district at Ayer panas (*Ridley* No. 1580 in Herb. Beccari) and at Bukit Sadanan *Ridley* $\frac{\text{R.D.}}{959}$ and $\frac{\text{R.D.}}{107}$ in Herb. Beccari; in the District of Perak (*Scortechini*); in the same district at Larut between 600–900 m. (No. 6388 in Herb. Calcutt.), and at Goping (No. 576 in Herb. Calcutt., *King's collector*); Negri Sembilan (*Ridley* No. 3505—Rotang chinchin)); at Selangore, Bukit Kutu (*Ridley*, No. 7882 in Herb. Calcutt.); at Johore *Ridley* (No. 10953 in Herb. Berol). In Sumatra: Mandau River, Siak, (*Ridley* No. 9093 in Herb. Kew). Malayan name "Rotang Simote" Griff., but probably correctly "R Sumut" or "the ant's Rotang".

OBSERVATIONS.—A very distinct species easily recognizable by the peculiar armament of its sheaths; by its spathes covered with seriate black spiculae; by its small round fruit etc. It is related to *D. geniculatus*, and the male spadices of both are very similar; the armament of the spathes is, however, very different, and so is that of the leaf-sheaths. The fruits of Scortechini's and King's specimens from Perak have dirty light-green or straw-yellowish scales; those of Ridley's specimens from Malacca and Negri Sembilan are reddish-brown, a difference probably depending upon the different degree of maturity.

D. verticillaris is essentially a myrmecophilous plant, as already pointed out by Griffith and probably there exists a connection between the nectar from the bodies in the male flowers, the strongly swollen axillary callus at every branching of the spadix, and the ant-harbouring galleries round the leaf-sheaths. Ridley (Mat. Fl. Mal. Pen. ii. p. 187) writes that Martius and Hooker have confused *D. verticillaris* with *D. periacanthus* "especially in the matter of the male flowers, those of the latter being described as those of this species." From what I can judge, however, by a large set of specimens at my disposal, the case is quite the reverse, and it seems to me that Mr. Ridley has described the male flowers of *D. verticillaris* as those of *D. periacanthus* Miq. and *vice versâ*.

Mr. Ridley mentions also Borneo as a locality for *D. verticillaris*, but I have seen no specimen thence.

PLATE 68.—Daemonorops verticillaris *Mart.* Upper portion of the sheathed stem with the base of a spadix; male spadix in flower; branchlet with full grown flowers in bud; outermost spathe; portion of a leaf, from near its base (undersurface). From Scortechini's No. 125^b in Herb. Beccari.

PLATE 69.—Daemonorops verticillaris *Mart.* Upper portion of leaf-sheath with the lower portion of a full grown fruiting spadix and the base of a petiole; two entire seeds, and one in halves longitudinally cut through the embryo. From No. 6388 in Herb. Calcutta. Upper end of female spadix with very young fruits, from No. 546 in Herb. Calcutta.

65. **DAEMONOROPS FORMICARIUS** Becc. Nelle Foreste di Borneo (1902) 608, and in Rec. Bot. Surv. Ind. ii, 226.

DESCRIPTION.—Scandent, slender and at times very slender. *Sheathed stem* 8–20 mm. in diameter. *Leaf-sheaths* non-gibbous above, obliquely truncate, and densely bristly at the mouth, each furnished with several membranous spiculiferous collars, of which two are usually paired, and are very large and broad; these latter are opposed, *i.e.*, the lower is turned upwards, the upper downwards, thus interlacing their spines, and forming complete and closed ant-harbouring galleries; the other unpaired collars are smaller, horizontal or deflexed; the spiculae edging the membranous collars are very long, shining, black or spadiceous, excessively slender and brittle. *Leaves* rather elongate, but very variable in size, according to the general dimensions of the plant, and terminating in a more or less elongate, at times rather short, slender cirrus; petiole elongate, 25–35 cm. long, 4–5 mm. broad, somewhat flattened-biconvex, armed at the base on the very obtuse edges, and frequently also on the under surface along the centre, with a few 4–5 cm. long, straight, slender, light-coloured spreading spines, and higher up with short prickles; upper surface quite smooth; rachis armed beneath with very small, solitary claws, which become ternate, but never very robust, on the cirrus; above, the rachis has the salient angle narrowly furrowed along its centre, the furrow being produced by the decurrent basis of the mid-costae of the segments, which run parallel, and very close together, but do not unite on the edge of the salient angle; leaflets numerous, equidistant, approximate (10–15 mm. apart), narrow, linear-lanceolate, the medials varying, according to the size of the leaves from 15–27 cm. in length and from 10–15 mm. in width, very thinly papyraceous, green, slightly paler beneath, broadest below the middle, then tapering somewhat towards the base but gradually diminishing above to a very acuminate and bristly tip, subtricostulate, *i.e.*, their mid-costa is acute and bristly near the apex, and one nerve on each side of it is slightly stronger than the others but both are furnished with several blackish sub-bristly spinules; underneath the mid-costa alone is finely and rather closely bristly; transverse veinlets not very numerous, translucent, much interrupted, rather sharp on both surfaces; margins rather spreadingly ciliate-spinulous. *Male spadix* . . . . *Female spadix* axillary in appearance, short, erect and rigid, 15–30 cm. long, including a short (about 5 cm. long), flattened, smooth peduncular part; primary spathes deciduous (not seen by me); flowering panicle short, loosely thyrsoid, formed by 5–6 partial inflorescences; secondary and tertiary spathes very small, scarious, very shortly annular-amplectent, produced at one side into a finely subulate point; the partial inflorescences sessile, small, the lower 4–7 cm. long, and with 2–5 distichous, gradually diminishing, spreading spikelets on each side, the others shorter and with fewer spikelets; their axes more or less obsoletely angular or sub-tetragonous; the lowest partial inflorescence is inserted just at the axilla of the outermost spathe; spikelets erecto-patent, the lower 2–2·5 cm. long and with 3–5 flowers on each side, the upper shorter and with fewer flowers; spathels small, scarious, very shortly annular-amplectent, produced at one side into a triangular, finely subulate point; involucrophorum callous in the axilla, distinctly pedicelliform, slightly flattened, 2–4 mm. long, rather slender, somewhat broadening towards its upper end where it is extended at one side into a broad, triangular acute point; involucre slightly protruding beyond the involucrophorum, and somewhat broader, discoid with a narrow annular subcallous rim round a broad, flat, circular scar; areola of the neuter flower depressed with a rather conspicuous scar. *Fruiting perianth* very shortly and broadly obconical in the part corresponding to the tubular part of the calyx; the corolla twice as long as the calyx, its segments spreading, narrow lanceolate, finely striate. *Fruit* spherical, 14 mm. in diameter, very shortly and acutely beaked; scales arranged in 15 longitudiual series, regular, rhomboidal, obtuse, not deeply but very regularly narrowly grooved along the centre, dull and almost pulverulent, of a chocolate-brown colour, with a narrow, sharply defined, lighter-coloured marginal band, the margins not or very obsoletely erosulate. *Seed* globular, 10 mm. in diameter, pitted on the surface; chalazal fovea very small, punctiform, superficial in the centre of the raphal side; embryo almost basal.

Habitat.—Borneo, on Mount Mattang near Kuching in Sarawak (P. B. Nos. 2552 and 1923, in Herb. Beccari). Malay name "Rotang Rappan". At Mattang it has been found again recently by *Hewitt.*

Observations.—A very peculiar species, distinguished even amongst those which have the sheaths ornamented with criniigerous collars by its leaves with their numerous equidistant approximate leaflets and by its small chocolate-brown spherical fruits, and by the short spadices which have exactly as many primary spathes as there are partial inflorescences; whereas in such species the outermost and often the second spathe bear no inflorescence at their axils, and the spadices are furnished with one or two internodes, forming additional peduncular parts inside the first spathe; but in *D. formicarius* such additional peduncular parts do not exist for even the outermost spathe encloses a partial inflorescence.

The presence of ants inside the galleries formed by the membranous pairs of collars and among the long spiculae which radiate from their margins, is fully attested, even in Herbarium specimens, by the rubbish brought thither, and cemented to the spiculae by those insects.

I have preserved only two specimens of *D. formicarius* of very different sizes; one (No. 1923) is much less stout than the other (No. 2552); the first has a leaf 30 cm. long in the pinniferous part, and terminates in a slender cirrus of equal length; in the other, shown in the plate, the pinniferous part is 65 cm. long, and terminates in a rudimentary cirrus. One of Hewitt's specimens is still more robust than my No. 2552; it has a sheathed stem 2 cm. in diameter, the leaves are 80 cm. long in the pinniferous part, and terminate in a cirrus about as long, armed at very regular and short intervals with half-whorls of small claws; the spadix is 30 cm. long, and bears mature fruits. Another of Hewitt's specimens has fruits quite identical with those of the preceding, but has a sheathed stem only 12 mm. in diam. and one leaf is only about 45 cm. long in the pinniferous part, and the leaflets are 15 cm. long and 10 mm. broad.

PLATE 70.—Daemonorops formicarius *Becc.* Portion of the sheathed stem with two spadices of which the fruits have fallen; upper end of the same leaf attached to the stem. From P. B. No. 2552 in Herb. Beccari.

66. DÆMONOROPS CRINITUS Bl. Rumphia, iii, 27, pl. 136; Mart. Hist. Nat. Palm. iii, 329; Miq. Fl. Ind. Bat. iii, 98; Walp. Ann. iii, 479 and v, 828; Teijsm. Cat. Hort. Bog. 74; Becc. Malesia, ii, 79 and in Rec. Bot., Surv. Ind. ii, 226.

Calamus (sect. *Daemonorops*) *crinitus* Miq. Anal.! Bot. Ind. 6, and De Palm, Arc. Ind. 29; H. Wendl. in Kerch. Palm. 235.

Calamus manicatus Teijsm. and Binn. in Hort. Bog.; Miq. Fl. Ind. Bat. iii, 135; H. Wendl. in Kerch. Palm. 236.

DESCRIPTION.—Scandent, slender. *Sheathed stem* 9–12 mm. in diameter or at times more. *Leaf-sheaths* slightly gibbous above, furnished irregularly with 2–3 complete, annular, membranous, spiculiferous, deflexed collars; interposed between these are 3–4 or even at times more collars often incomplete, some fringed with spiculae pointing upwards, others with spiculae pointing downwards or horizontal; the spiculae are very slenderly criniform and brittle, quite black, shiny, unequal, short, or as much as 3–4 cm. in length, but of uniform thickness at their base; the mouth of the leaf-sheaths and the base of the petiole are also armed with small, transverse, interrupted series of similar spiculae. *Leaves* rather elongate, terminating in a slender cirrus, with rather numerous leaflets which, from as far as can be judged from the Herbarium specimens, are more or less inequidistant, but never grouped, in young plants or in the lower part of the stems; but in the upper and floriferous end are almost equidistant; petiole of moderate length (10–20 cm. long, 3–4 mm. broad) flattened-biconvex with not very acute edges which are sometimes armed very sparingly with remote, short, straight or slightly hooked prickles, otherwise smooth on both surfaces; rachis with an acute, smooth, salient angle and flat side-faces on the upper surface and armed underneath with small, solitary claws, which at the upper end and especially on the cirrus become ternate; leaflets papyraceous, green and concolorous on both surfaces, linear-lanceolate, broadest about the middle, thence tapering towards the base and gradually acuminate to a subulate and bristly tip; they are obsoletely 3-costulate and bristly-spinulous on the mid-costa underneath, otherwise glabrous on both surfaces; transverse veinlets short, not very crowded, rather sharp on both surfaces; margins very minutely, appressedly, and rather remotely spinulous; the largest leaflets (those a little above the base) are 25–27 cm. long and 15–20 mm. broad, the others gradually become shorter, but not or only slightly narrower. *Male spadix......Female spadix* slender and cylindraceous before flowering; the outer spathe crinite or with its upper part clothed with black, shiny, long, criniform bristles. *Fruiting spadix* about 50 cm. long, nodding, slender, narrowly panicled; its peduncular part slender, strongly flattened, 5–7 cm. long, its edges not very acute and slightly prickly only towards the upper end; all the axial parts of the spadix covered with a dark, rusty-brown, furfuraceous indumentum; the lowest internode slightly clavate, very slightly flattened, 4 cm. long, 4 mm. thick; the other internodes more or less angular, and more slender; partial inflorescences 5–6, the lower 9–10 cm. long and with 4–5 bifarious spikelets on each side; upper inflorescences somewhat smaller; secondary and tertiary spathes very shortly annular-amplectent, very slightly produced on one side into a triangular, acute point; the lower spikelets of each inflorescence the largest, 3–4 cm. long, with two series of slightly unilateral flowers of 3–7 flowers each; the other spikelets somewhat smaller; the axes of the spikelets angular, and sinuous; spathels very shortly annular-amplectent, produced at one side into a short broad, acute, triangular point; involucrophorum very shortly pedicelliform, 1 mm. long, comparatively thick, angular, truncate, and very slightly produced at one side into a short triangular point; the involucre protrudes very slightly beyond the involucrophorum and has a very narrow, annular explanate limb, around the larger flat orbicular end; areola of the neuter flower small, slightly concave or niche-like, the scar non-swollen. *Flowers* and *fruit* unknown.

HABITAT.—Blume writes that the type specimens of *D. crinitus* were collected by *Korthals* in S. Borneo on the River Dusson. The plants cultivated at Buitenzorg, under the name of *D. manicatus*, are from seed collected at Palembang in Sumatra. From this same locality, specimens exactly identical with Blume's typical *D. crinitus*, were forwarded to Prof. Martelli in 1906 by Resident *J. A. van Rijk van Alkemade.* It is therefore quite certain that the native country of *D. crinitus* is Sumatra.

OBSERVATIONS.—I have seen one of Blume's authentic specimens, of *D. crinitus* which exactly corresponds to its plate in the "Rumphia." I have however described the specimens from the plants cultivated at Buitenzorg under the name *Calamus manicatus* T. and B., Palembang, 5983 "Rotang latjap," which also exactly agree with Blume's type of *D. crinitus.*

The Buitenzorg specimens have very young spadices, and the outer spathes in their upper part densely crinite, whereas the plate in Rumphia represents this part as smooth; but as Blume says that the spiculae are deciduous, it is possible that the spathes may appear glabrous when old, and bristly in youth.

Miquel had already reduced *C. manicatus* Teijsm et Binn. to *D. crinitus* (De Palmis p. 22) and I verified the correctness of this identification by inspection of the authentic specimens of both in the Herbaria of Leyden and Utrecht.

The locality of Java given by Miquel (Fl. Ind. Bat. iii, 136) for *C. manicatus* is apparently erroneous, as probably is that of Borneo given by Blume for *D. crinitus*, as it is not likely that a species of *Dœmonorops* of this group should be represented in two rather distant regions with exactly the same characters.

I refer to *D. crinitus* a specimen from Sumatra preserved in the Herbarium at Buitenzorg (No. 2022) having the label "*Calamus crinitus*. Rottan tjentjen. Priaman" without the name of the collector. This specimen is from a more robust plant than those described above; it has the sheathed stem about 2 cm. in diameter, but covered with the crinigerous collars, and rows of spiculae as in the others; the leaves are also larger, but none are entire; the petiole is 13 cm. long, 12–13 mm. broad, flat on the upper surface, convex on the back and with a line of small claws along the centre, and it is slightly armed on the edges with small prickles; the rachis is flat in its lower portion, has slightly spinulous acute edges and narrowly grooved sides, and towards the upper end has flat side-faces, and an acute smooth or scantily spinulous salient angle; the leaflets are numerous, almost equidistant, linear, 30–35 cm. long, very acuminate, 12 mm. broad, bristly on 3 nerves on the upper surface, but only on the mid-costa on the lower. Probably this specimen collected in West Sumatra represents a local variety of the plant growing in Palembang which must be considered as the typical.

PLATE 71.—Daemonorops crinitus *Bl.* Upper end of a stem with a very young spadix; portion of the sheathed stem with an entire spadix from which all the fruits have fallen. The specimens in Herb. Beccari from a plant cultivated at Buitenzorg.

67. DAEMONOROPS ANNULATUS Becc. in Rec. Bot. Surv. Ind. ii, 227.

DESCRIPTION.—Scandent and slender. *Sheathed stem* 15–16 mm. in diameter; the internodes rather elongate. *Leaf-sheaths* slightly gibbous above, obliquely truncate and spinous at the mouth, furnished with several (6–7) broad, complete, membranous, spiculiferous, deflexed collars, and with 2–3 other similar collars, equally large, but ascendent; these paired collars form between them 2–3 spacious, perfectly horizontal, annular ant-harbouring galleries round the stem immediately below the base of the petiole; alternating with the double large collars, and half-way between each pair is another complete, also perfectly horizontal, spiculiferous ring; the marginant spiculae or spines are apparently very brittle, as they have all fallen off in the specimen I have examined. *Leaves* about 50 cm. long in the pinniferous part, terminating in a rather long, clawed cirrus; leaflets very conspicuously aggregated into a few remote groups; petiole very long (54 cm. in one specimen), slightly flattened-biconvex from just above its base, its edges obtuse, and armed from the base upwards with several small claws, smooth on both surfaces, except for a few small claws along the dorsum, near its upper end; the rachis has, immediately from the insertion of the lowest leaflets, an acute and smooth salient angle, with slightly concave side-faces above, while underneath, it is, as usual, armed, first with solitary, and then with 3–5-nate claws; leaflets very few, only 19 in one specimen, disposed in 3 almost equal, very remote groups, all in one plane, and not pointing in different directions, considerably approximate in each group by their bases, papyraceous, green on both surfaces, elongate-oblanceolate, tapering considerably towards the base, broadest above the middle, and thence shortly acuminate upwards to a slightly bristly tip, tricostulate, all nerves bald on both surfaces; margins slightly spinulous but only near the upper end; the largest leaflets are those of the lowest group, 35–40 cm. long, 3 cm. broad; those of the terminal group are shorter (25 cm. long at most) and narrower (10–12 mm. broad) being broadest about their middle. *Flowers...* *Fruits....*

HABITAT.—North Borneo: on the Lawas River (*Burbidge* in Herb. Kew.).

OBSERVATIONS.—The only specimen of this species seen by me is an entire leaf with a portion of the sheathed stem apparently gathered from a full grown plant. In the disposition and shape of the leaflets it mostly resembles *D. Sabut*, from which it differs in having 2–3 pairs of collars, which form corresponding complete ant-harbouring galleries in the upper part of each leaf-sheath, just below the base of the petiole; the spines and spiculae radiating from the edges of the collars are probably very long and slender, as in the allied species, but none remain on the specimen I have examined.

PLATE 72.—Daemonorops annulatus *Becc.* It represents the entire type specimen in Herb. Kew.

68. DAEMONOROPS MIRABILIS Mart. Hist. Nat. Palm. iii, 206 (2nd edit.) and 326, pl. 115, f. ii, b.; Miq. Fl. Ind. Bat. iii, 98; Walp. Ann. iii, 478 and v, 828; Becc. Malesia. ii, 79 and in Rec. Bot. Surv. Ind. ii, 226.

Calamus (?) *mirabilis* Mart. l. c. 213 (1st edit.); Miq. De Palm. Arc. Ind, 29; Kunth, Enum. Pl. iii, 213; H. Wendl. in Kerch. Palm. 237.

DESCRIPTION.—Apparently scandent. *Sheathed stem* of middling size, 2·5–3 cm. in diameter. *Leaf-sheaths* slightly gibbous above, each furnished with several pairs (5–6) of very broad, complete, membranous, radiately-striate, decussating collars, all equal in size, of which each pair contains a gallery quite closed in by the crossing and interlacing of the long black spiculae which fringe each half pair; these pairs of collars are 10–20 mm. apart; interposed between the broad double collars are 2–5 single, membranous, horizontal rings, which are also spiculiferous, but form no galleries; such single rings surround the lower portions of the leaf-sheaths more frequently than the upper; the spiculae of all the collars are criniform, 3–5 cm. long, or at times shorter, rigid, brittle, black with a lighter-coloured base; the base of the petiole is armed on the back with irregular, interrupted rows of pectinate, black-tipped, slender spines; the petiole is 15 mm. broad a few centimetres above the mouth of the leaf-sheath, flat on the upper, and convex on the lower surface, and has a few pectinate and divaricate spines on the edges which are larger than those on the back. Other parts unknown.

HABITAT.—Probably South Borneo. The type specimens in the Herbarium at Brussels.

OBSERVATIONS.—*D. mirabilis* was established on only a portion of two sheathed stems, which I have examined and described above. One of these stems is 2·5, the other 3 cm. in diam.; they were sent by Reinwardt to Martius, without any special note of their place of origin. *D. mirabilis* is certainly a very singular Palm, and among all the species of myrmecophilous *Daemonorops* it certainly possesses the best developed ant-harbouring galleries encircling the leaf-sheaths.

In *D. mirabilis* the galleries are formed by two equal opposed collars, of which the membranous part is as much as 10–12 mm. broad, their respective edges being in contact while the spines are set so closely together, as to form an impenetrable stockade by which the circular galleries are entirely closed in; should any ants desire to penetrate inside the galleries, and establish their abode therein they can do so only by gnawing through the rims of the collars. In one of the leaf-sheaths which I examined, and which was 15 cm. in length, I counted 5 complete galleries of these. The lower 4 had each a circular hole in the upper collar made by the ants, exactly in the same vertical line, by which the ants could, as by gates, communicate with the exterior; the uppermost gallery had no such hole, as the edges of the collars were not in contact here, and the ants had been able to penetrate inside through the interstices between the spines; here however they had carried up some rubbish to close the fissures.

DAEMONOROPS MIRABILIS var. OLIGOCYCLIS Becc.

DESCRIPTION.—Scandent, slender. *Sheathed stem* 17 mm. in diameter. *Leaf-sheaths* furnished in their upper part with only one complete pair of equal, broadly membranous, spiculiferous, opposite collars, the remaining portion being surrounded by several such membranous spinuliferous collars but all single and reversed; the latter are interposed between horizontal rings of radiating spiculae, all the spiculae being very fine, unequal and black with a lighter-coloured base. *Leaves* 60 cm. long in the pinniferous part, with 23 leaflets in all (in one specimen), approximated into 5 groups, of which the lowest is composed of 7 leaflets; petiole somewhat flattened biconvex, with the edges and the dorsum along the centre armed with short solitary claws; on the upper surface the petiole has a few small prickles near its base; the rachis has the upper surface at first very narrow and flat, with a broad groove on each side, but it soon becomes trigonous in section, with an acute smooth salient angle; leaflets very narrowly lanceolate or oblanceolate; those of the lower group about 40 cm. long, 3 mm. broad and broadest above their middle; those of the upper groups shorter, but very slightly narrower, and broadest at about their middle; they have 3 very remotely spinulous nerves on their upper, but are smooth on their lower surfaces. *Spadices* when very young cylindraceous, with a very short, flat, unarmed, peduncular part; primary spathes tubular, the outermost pervious at its upper end, the inner protruding one beyond the other, rather densely clothed, especially on their upper part, with blackish or spadiceous, needle-like or criniform confluent and shortly seriate spiculae. *Flowers......Fruits.*

HABITAT.—Cultivated in the Botanical Garden at Buitenzorg as introduced from Borneo. (Herb. Beccari.)

OBSERVATIONS.—This variety differs from the typical *D. mirabilis* in having only one pair of equal, opposite, complete, membranous collars instead of several. But it is possible that besides this peculiarity in the leaf-sheaths, other characteristics in other parts of the plant may await notice, and that this variety really deserves to be elevated to specific rank.

I do not think it quite improbable, that the differentiations of the species of *Dœmonorops* to which *D. mirabilis* belongs, may not originally, as far as the peculiarities of the leaf-sheaths are concerned, have been caused by the stimulating action of ants upon them, and have been rendered permanent by heredity, and that the mutualism of these insects with the plant may also, during the same time, have modified others of its even more important organs.

I refer to *D. mirabilis* var. *oligocyclis*, some specimens collected by *H. Hallier* in Dutch N.W. Borneo, Ulu kenepai, Residency of Sambas (No. 1452, Herb. Buitenzorg). These apparently belong to young plants, have slender stems, and non-cirriferous leaves; some of the latter have few leaflets approximate in few distant groups, or have almost digitate leaflets, 7–8 in number, at the end of the petiole, the disposition of the collars being as already described.

PLATE 73.—Daemonorops mirabilis var. oligocyclis *Becc.* The lower part of a leaf with the upper portion of its leaf-sheaths; the upper end of the same leaf; 2 very young spadices. From a plant cultivated at Buitenzorg (Herb. Beccari).

69. DAEMONOROPS PSEUDO-MIRABILIS Becc. in Rec. Bot. Surv. Ind. ii, 226.

DESCRIPTION.—Scandent. *Sheathed stem* of moderate size, 2 cm. in diameter. *Leaf-sheath* slightly gibbous above, rather thin and easily splitting longitudinally, furnished with several (6–7) large, complete, broadly membranous, spiculiferous, reversed collars, and with an equal number of similar collars, in close proximity to the former, but turned upwards, smaller, and with a narrower membranous part; between these pairs of collars, of which the long spiculae meet and cross frequently, are interposed simple rows of horizontal spiculae; the larger pairs of collars form as many circular galleries, but the membranous part of the upper or reversed collar, which is very much like a short petticoat, is considerably larger than its lower upturned partner; the spiculae are shiny, very slender and unequal, some, which are larger than others, are spadiceous, or of a light-brown colour, and up to 6–7 cm. long, but always very narrow; others, usually alternating with the larger, are blackish, criniform, brittle, and of variable length; the mouth is also armed with such spiculae. *Leaves* with a comparatively short (50–60 cm.) pinniferous part, a long petiole, and a long and slender cirrus; the petiole alone is 35–40 cm. long, 7–8 mm. broad, somewhat flattened-biconvex, polished, with very obtuse edges, smooth on the upper surface, armed at the base and on the back with a few horizontal, spiculiferous crests, and along the margins, and along the centre of the dorsum with black-tipped solitary claws; the petiole diminishes abruptly in thickness, and passes into the rachis just at the insertion of the lowest leaflets; the rachis, on the upper surface, is smooth, and has an acute salient angle, with flat side-faces, and is armed on the back with, at first, solitary, but higher up, 3-nate, 5-nate, and finally, but especially on the cirrus, half-whorled claws; leaflets very few, 10–15 in all, disposed in 3–4 groups, with long vacant spaces interposed; the lowest group is the largest and has 6–7 leaflets which are very approximate by their bases, point in different directions, and are larger than those of the upper groups; the other groups are composed of only 2–4 leaflets, 2–5 cm. apart; the leaflets are papyraceous, green and subconcolorous on both surfaces, narrowly lanceolate or elliptical-lanceolate, broadest about their middle, and thence tapering to a rather acute base, and diminishing above to a subulate and bristly tip; they are subtricostulate, or with a slender mid-costa, and one secondary nerve on each side of it, stronger than the others, all 3 minutely and sparingly spinulous on the under-surface; all nerves very slender and glabrous; transverse veinlets very numerous and approximate, very slender but rather sharp on both surfaces; margins closely and very minutely spinulous. *Male spadix* ... ... *Female spadix* forms a rather long, loose and nodding panicle when in fruit, 80–85 cm. long, with 6–7 partial inflorescences borne on a very short (4 cm. long, 1 cm. broad), flattened, smooth, obtusely two-edged, peduncular part; the two first internodes of the main axis slightly flattened and slightly clavate, 4–5 cm. long, the other internodes more elongate, obsoletely angular and distinctly marked by the depressions left by the adjoining parts during prefloration; primary spathes........., the lower partial inflorescences very loose, 15–18 cm. long, with only 4–5 bifarious spikelets on each side; the upper partial inflorescences somewhat shorter and with fewer spikelets; their axes acutely angular; secondary and tertiary spathes very small, very shortly annular-amplectent, extended on one side into a very small triangular acute point; spikelets slender, the lower 8–10 cm. long with 6–7 bifarious flowers on each side, the upper 6–7 cm. in length and with proportionally few flowers; they are kept spreading when in fruit by a distinct axillary callus, their axes are zigzag sinuous and very acutely angular; spathes very shortly annular-amplectent, produced at one side into a triangular point; involucrophorum pedicelliform, 2–4 mm. long, distinctly callous at its axilla, angular, slightly narrowing towards the base, truncate and very slightly produced on one side at the upper end; involucre slightly protruding beyond the involucrophorum, reduced to a very narrow annular limb round the large circular flat scar left by the fallen flower; areola of the neuter flower small but distinct, at least in the flowering period, concave, niche-like, with a non-swollen scar. *Fruiting perianth* very broadly obconical, and therefore very shortly pedicelliform. *Fruit* spherical, very shortly and abruptly conical-beaked, 14 mm. in diam. (only one seen by me); scales arranged in 15 longitudinal series, strongly convex, distinctly grooved along their centres, of a brown-yellowish colour and tinged with red, especially posticously; the margins lighter coloured, scarious, very finely erose; the tip obtuse.

Habitat.—Cultivated in the Botanic Garden of Buitenzorg where it is said to have been introduced from Palembang. Malay an name "Rotang Lela."

Observations.—Very similar to *D. mirabilis*, from which it differs in the rather different disposition of the collars around the sheaths, if this can be taken as a true and reliable character.

In *D. mirabilis* 5 or 6 large collars are immediately opposed to other collars of equal breadth, and with these latter form complete closed circular ant-galleries; but in *D. pseudo-mirabilis* 6–7 large, reversed, membranous collars, which like small petticoats, clothe at almost regular and short intervals every leaf-sheath, are opposed to much narrower collars, and consequently the resulting galleries are not entirely closed by the membranous part of the collars, but by their decussating spiculae.

To *D. pseudo-mirabilis* would appear to belong a specimen forwarded to me by Mr. H. N. Ridley under No. 3515, but I do not know if it was gathered on a wild plant, or on one cultivated at Singapore in the botanical garden; this specimen consists of an intermediate portion of a leaf with two groups of leaflets, and of the terminal portion of a spadix with full grown fruits. The leaflets differ from those of the specimen from Buitenzorg, described above, only in the nerves being quite smooth and bare on both surfaces; the spikelets in the Singapore specimen are slightly shorter than in the other, while the fruits are rather larger; its fruits are 14–16 mm. in diameter; the scales are of an uniform yellowish-brown colour; the seed is enveloped in an abundant crustaceous (once fleshy) integument; divested of this it is conspicuously flattened, laterally subreniform, 11 mm. long, 9 mm. broad, 6 mm. thick, rather minutely pitted, with a small round chalazal fovea almost in the centre of the raphal side; albumen deeply ruminated; embryo basal.

Plate 74.—Daemonorops pseudo-mirabilis *Becc.*? Upper end of a fruiting spadix; intermediate portion of a leaf (under-surface). From Ridley's specimen No. 3515 in Herb. Beccari.

Plate 75.—Daemonorops pseudo-mirabilis *Becc.* Portion of the sheathed stem; the upper end of a leaf; fruiting spadix; a small portion of a leaf-sheath split longitudinally, showing on one of its edges the collars in section and the spines crossing each other. From a plant cultivated at Buitenzorg (Herb. Beccari).

70. Daemonorops Forbesii Becc. in Rec. Bot. Surv. Ind. ii, 227.

Description.—Scandent, slender. *Sheathed stem* 10–12 mm. in diameter. *Leaf-sheaths* cylindrical, ultimately glabrous, rather thin, easily splitting longitudinally, slightly gibbous above, furnished in their upper part with a large and complete, broadly membranous, reversed, light-coloured collar, formed by the confluent bases of numerous, very slender, filiform, bristly spiculae, of which some are as much as 4–5 cm. long, filiform, delicate, flexible, of a straw-yellow colour, and others, which alternate with these, are shorter, criniform, black and brittle; in opposition to this large collar is another, turned upwards, formed almost entirely by the bases of black, criniform bristles; the two opposite collars form a circular gallery, the abode of ants; below this pair of collars are 1-2 others of the same kind but considerably smaller, and then follow several, almost horizontal, complete, or in the lower part of the sheath interrupted, circular rows of small criniform ascendent spiculae. *Leaves* about 50 cm. long in the pinniferous part, and terminated by a long cirrus; the petiole alone is 23–25 cm. long, somewhat flattened-biconvex with very obtuse edges that are rather remotely clawed; a few small claws appear also on the upper part of the dorsum along the centre; the upper surface of the petiole is smooth; the rachis is slightly thicker in the portion corresponding to the insertions of the groups of leaflets than elsewhere; on the upper surface it is smooth and has a salient angle with flat side-faces; on the under-surface, it is armed lower down with solitary, rather robust claws, which become ternate higher up and finally 5-nate on the very long comparatively terminal cirrus; leaflets very few (in one specimen only 27 in all), approximate in number or 3–5 on each side of the rachis and arranged in 3 distant (8–10 cm. apart) groups; in each group the leaflets are almost equidistant, and 10–15 mm. apart on each side of the rachis, are all in one plane and nearly equal in size, 15–20 cm. long, 20–27 mm. broad; they are thinly papyraceous, green and concolorous on both surfaces, narrowly lanceolate or elliptical-lanceolate, being broadest about the middle, and thence tapering towards a rather acute base, while somewhat suddenly acuminate to a bristly tip, which is rather conspicuously indented on the lower margin, about 2 cm. below the apex; on the upper surface the mid-costa is slender but very sharp; usually it has a few bristly spinules near the apex; the secondary nerves are many, one on each side of the mid-costa being a trifle stronger than the others, and occasionally carrying a few scattered spinules here and there; on the under-surface 5 very slender nerves are furnished, from the base to the apex, with several black, short, spreading, rather conspicuous bristles; transverse veinlets numerous and sharp on both surfaces; margins acute, finely, and near the apex, spreadingly spinulous-ciliate. *Male spadix....* *Female spadix* when in fruit diffusedly panicled, nodding, about 50 cm. long (in one specimen); its peduncular part is rather elongate (15 cm. long), somewhat flattened and with obtuse edges. of the uniform breadth of 5 mm. throughout, feebly armed with fascicles of spiculae and with a few small prickles; the axial parts are more or less covered with a thin, furfuraceous, rusty-brown indumentum; the main axis is straight, rather slender; the two lowermost internodes are subterete and slightly clavate, the others obsoletely and irregularly angular; primary spathes deciduous (not seen by me); partial inflorescences 4–5 in number, spreading, and with a distinct axillary callus, their axis angular, slightly sinuous; the largest are 10 cm. long and carry distichally 3–4 almost horizontal spikelets on each side; the succeeding ones are slightly smaller, and the ultimate have only a few short spikelets; secondary spathes small, embracing, and with a small but distinct, almost horizontal, broadly triangular, acute limb; the spikelets are 4–5 cm. long and have 3–5 flowers on each side; involucrophorum pedicelliform, trigonous, slightly tapering towards the base and with a distinct axillary callus, spreading or almost horizontal, flat at the upper end, where it is very slightly produced at one side into a small triangular acute point; involucre almost at a level with the involucrophorum, flat-discoid, orbicular, with an almost inconspicuous annular limb; areola of the neuter flower very small, punctiform, slightly callous. *Female flowers* (judging from their remains in the fruiting perianth) narrowly conical, 3–3·5 mm. in diameter on the flat base, and 7 mm. long; the calyx shallowly cupular, truncate, with 3 small apicules; the corolla about 5 times as long as the calyx, divided down almost to the middle into 3, narrowly triangular, acute segments. *Fruiting perianth* with a distinct pedicelliform cylindraceous base, 2–3 mm. long. *Fruit* globular-ellipsoidal or broadly ovoid-elliptical, rounded at both ends but very abruptly terminating in a distinct conical beak, caudiculate at the base, 23–24 mm. long, including the beak and perianth, 16–17 mm. broad; scales arranged in 15 longitudinal series, polished, exactly rhomboidal, narrowly grooved along the centre, orange when fresh, straw-coloured with a reddish hue when dry; their point not produced and obtuse; the margin minutely erose. *Seed* oblong, rounded at both ends, somewhat laterally flattened, finely tubercled, 15 mm. long, 12 mm. broad, 10 mm. thick; embryo basal.

HABITAT.—Sumatra. Discovered by *H. O. Forbes* in 1881 at Pane Passumah at about 1200 m. elevation. No. 2538 in Herb. Calcutt.

OBSERVATIONS.—In the group of *D. mirabilis* it is distinguishable by its leaf-sheaths which have only 1–2 pairs of collars in their upper part, by its leaflets with 5 bristly nerves on the under-surface, and by the cylindraceous and distinctly pedicelliform fruiting perianth.

PLATE 76.—Daemonorops Forbesii *Becc.* From the type specimen No. 2538 in the Herb. Calcutt.

71. DAEMONOROPS SABUT Becc. in Hook. f. Fl. Brit. Ind. vi, 469 and in Rec. Bot. Surv. Ind. ii, 227.

DESCRIPTION.—Scandent, slender. *Sheathed stem* 11–12 mm. in diameter. *Leaf-sheaths* cylindrical, elongate, bristly-spinulous at the mouth, covered while young with a rusty cottony furfuraceous scurf, rather thin and easily splitting longitudinally, each furnished with 2–3 complete, broad, membranous, reversed, petticoat-like, light-coloured collars, formed by the confluent bases of numerous, very slender, needle-like, unequal, at times very long, black spiculae; in addition to these large collars and interposed between them are several other narrower rings, from which radiate innumerable, small, black, bristly spiculae that generally point downwards, but, at times, are almost horizontal; collars or rings in opposition to the reversed collars are wanting. *Leaves* 1–2 m. long (in one specimen) including the petiole and a very short rudimentary cirrus; the petiole alone is 40 cm. long, terete, 6–7 mm. in diameter, armed all round, especially at its base, with straight, digitate, divergent spines; the rachis on the upper surface has an acute, smooth, salient angle with slightly concave side-faces from the insertion of the lowest leaflets; on the under surface, the rachis is armed with 3-nate claws, which become smaller at the sub-cirriferous end; leaflets 32 in all (in one specimen), aggregated into 4 groups, separated by long vacant spaces; they are papyraceous, rigidulous, green, apparently paler beneath, narrowly oblong-oblanceolate or broadest above the middle, tapering thence gradually towards the base and shortly acuminate, sometimes rather abruptly, to a bristly caudiculate tip; on the upper surface they are rather distinctly 3-costulate, *i.e.*, they have the mid-costa and one sharp nerve on each side of it; all 3 carry short black bristles from about the middle upwards; on the under surface the mid-costa alone is minutely bristly-spinulous in its anterior half; transverse veinlets sharp, rather numerous; margins minutely and rather closely spinulous; in the groups the leaflets are all in one plane, and rather approximate, but not very regularly set; in the lowest group more numerous (6 on each side) and also larger (up to 30 cm. long and 3 cm. broad) than in the upper groups; the terminal group is composed of 4, that are 10–12 cm. long, and 15–20 mm. broad.

HABITAT.—The Malayan Peninsula in the district of Perak, on the Gunong Tambang Batak. *Scortechini* (No. 653^b in Herb. Beccari). Malayan name—"Rotang Sabut."

OBSERVATIONS.—Of this I have seen only an entire leaf with a portion of the sheathed stem. This specimen is apparently gathered from a plant not yet full grown, as the leaf is only rudimentarily cirriferous. In the absence of more complete specimens I remain uncertain if the differences existing between *D. Sabut* and *D. oligophyllus* are specific, or result from peculiar conditions of vegetation. *D. Sabut* is also closely related to *D. Forbesii*, but in the latter the leaflets are not distinctly tricostulate. *D. Sabut* differs from *D. oligophyllus* in the sheaths being bristly-spinulous at the mouth and more regularly armed with complete horizontal rings of spiculae; in having larger leaves with terete petioles and more groups of oblong-oblanceolate leaflets and these bristly on 3 nerves on the upper surface.

PLATE 77.—Daemonorops Sabut *Becc.* It represents the entire Scortechini specimens in Herb. Beccari.

72. DAEMONOROPS OLIGOPHYLLUS Becc. in Hook. f. Fl. Brit. Ind. vi, 470 and in Rec. Bot. Surv. Ind. ii, 227.

DESCRIPTION.—Scandent, slender. *Sheathed stem* 9–12 mm. in diameter. *Leaf-sheaths* cylindrical, truncate and unarmed at the mouth, covered in youth with a rusty, cottony down, later glabrous, rather thin, easily splitting longitudinally, slightly gibbous above, furnished with 3–4 complete, membranous, green, reversed collars, formed by the confluent bases of numerous, very slender, needle-like, unequal, at times very long, black or spadiceous, shining spiculae; with these, the leaf-sheaths have many either complete, or more or less interrupted, rows of similar, but smaller, confluent and ultimately deciduous spiculae; all the collars and rows of spines are reversed, and none point upwards. *Ocrea* obsolete. *Leaves* small, 70–90 cm. long, including the petiole and the cirrus; the pinniferous part is very short, and has very few (10–13) leaflets, aggregated into 2-3 remote groups; the petiole is 20–30 cm. long, somewhat flattened-biconvex, with very obtuse edges that are armed with very small prickles; some of these stand also on the upper surface near the base; underneath, the petiole is armed from the base upwards with digitate claws; the rachis has on the upper surface from the insertion of the lowest leaflets an acute salient smooth angle, and flat side-faces; on the under surface the rachis is rather powerfully and closely armed with 3-nate and 5-nate claws, which become gradually smaller on the slender cirrus; leaflets 10–15 mm. apart on each group (on each side of the rachis), papyraceous, rigidulous, green and concolorous on both surfaces, narrowly lanceolate, or elliptical-lanceolate, or sub-oblanceolate, acute at their bases and rather shortly, at times rather abruptly, acuminate to a brush-like tip; the mid-costa is slender but very sharp, sparingly bristly-spinulous on the upper, and smooth on the lower surface; the secondary nerves on both surfaces are all slender and smooth; transverse veinlets rather sharp, not very approximate; margins minutely and appressedly spinulous; the leaflets of the lowest group (about 6) are larger,—10–16 cm. long, 15–20 mm. broad—than those of the upper two; in the second group the leaflets are fewer, smaller, and less closely set; the third, when there is one, has only one or two diminutive leaflets. *Flowers*... *Fruit*....

HABITAT.—The Malayan Peninsula in the District of Perak, *Scortechini* in Herb. Beccari.

OBSERVATIONS.—Of this I have seen only two leaves with a portion of the sheathed stem. It is certainly closely related to *D. Forbesii*, but differs from it in the ornamentation and armament of the leaf-sheaths; these latter having only reversed membranous collars, and reversed rows of black spiculae, and wanting spiculiferous collars or rows of spiculae turned upwards; moreover, the leaflets of *D. oligophyllus* are slightly bristly only on the mid-costa above. See observations to *D. Sabut*, which *D. oligophyllus* closely resembles.

PLATE 78.—Daemonorops oligophyllus *Becc.* It represents Scortechini's specimens in Herb. Beccari.

73. DAEMONOROPS COLLARIFERUS Becc. in Rec. Bot. Surv. Ind. ii, 227.

DESCRIPTION.—Scandent, rather slender. *Sheathed stem* 15–22 mm. in diameter, the internodes rather short. *Leaf-sheaths* not gibbous above, obliquely truncate at the mouth, armed with small erect spines exactly on the rim and around it, especially at the base of the petiole, with very long (as much as 5–9 cm.), often confluent and transversely seriate, needle-like, rigid, straw-coloured spines; immediately below the base of the petiole are two parallel collars, both deflexed, large, very broadly membranous and spiculiferous, and below these again are a few complete cristiform rings of horizontal spiculae; collars or rings of spiculae turned upwards, in opposition to the deflexed ones, are not present; the spiculae are very slender, blackish and deciduous with age. *Leaves* elongate, about 80 cm. long in the pinniferous part, and terminating in a rather long and slender cirrus; petiole elongate (40 cm. in one specimen), slightly flattened-biconvex with obtuse clawed edges in its upper part, the edges near the base acute and powerfully armed with very long, spreading spines, very much like those described above, but often fascicled 2–3 together and divergent; the under surface of the petiole is unarmed, the upper is sparingly and minutely prickly; the rachis on its upper surface has a smooth salient angle with flat side-faces immediately from the insertion of the lowest leaflets; beneath it is armed with ternate claws which become smaller and regularly half-whorled on the cirrus. *Leaflets* rather numerous, about 40 in all, very inequidistant, more or less distinctly aggregated into 5–6 groups, all in one plane (not pointing different ways) and 2–3 cm. apart in each group, the groups of one side alternating with those of the opposite side, and therefore with not very long vacant spaces interposed; they are thinly papyraceous, green, slightly paler beneath, linear, narrow and long, the lower leaflets being the largest (35–40 cm. long, 10–15 mm. broad), the upper a good deal shorter but not narrower, all very gradually acuminate to a subulate—and at the apex—bristly tip; on the upper surface the mid-costa is acute and glabrous or has a straggling spinule near the apex; the secondary nerves are slender and all smooth; on the under surface 5 nerves are finely bristly but the mid-costa has the bristles closer than the others; transverse veinlets rather sharp and numerous, much interrupted; margins very minutely spinulous. *Male spadix* erect, strict, panicled-cupressiform, about 50 cm. long and with 6–7 partial inflorescences (in one specimen) supported by a strongly flattened unarmed pedicellar part; primary spathes thin, membranous, deciduous, exsuccous; secondary and tertiary spathes very shortly infundibuliform or sub-bracteiform, produced at one side into a triangular, acuminate, exsuccous and usually lacerated point; partial inflorescences small and with few branchlets, the latter short (3–5 cm. long) with 3–4 spikelets on each side; spikelets spreading, 10–20 mm. long, quite flat, 8 mm. broad, of a cinnamon-brown colour when dry with 10–15 closely packed, bifarious, horizontal flowers on each side; spathels very closely packed, bracteiform, horizontal or slightly deflexed, broadly and shallowly cymbiform, puberulous-furfuraceous; their apex produced at one side into a triangular point, which protrudes beyond the involucre; the latter rather deeply cupular, obliquely truncate and entire at the mouth, two-keeled on the posticous side, not callous in the axilla. *Male flowers* terete, very slender, at times slightly arched, obtuse, 4 mm. long, the calyx tubular, broadly 3-toothed, the corolla more than twice as long as the calyx.

HABITAT.—Borneo. I collected this fine species in a sterile condition on Mount Mattang near Kuching in Sarawak. (P. B. No. 1923.) Found again in the same place and with male flowers by *J. Hewitt*. (Herb. Kew. and Manila.) Malayan name in Sarawak "Rotang Rappang."

OBSERVATIONS.—It is easily distinguishable from the allied forms by the two large membranous reversed collars immediately below the base of the petiole; by the want of collars or rows of spiculae turned upwards; and by the long needle-like, straw-coloured spines around the mouth of the leaf-sheaths, and at the base of the petiole. *D. collariferus* seems allied to *D. geniculatus*, more than to any other known species, by the long spines at the base of the petiole and by its flattened male spikelets with closely packed bifarious flowers; but *D. geniculatus* has only partial membranous crests around the leaf-sheaths, not complete reversed collars.

PLATE 79.—Daemonorops collariferus *Becc.* It represents the type specimen: P. B. No. 1923 in Herb. Beccari.

74. DAEMONOROPS MACROPHYLLUS Becc. in Hook f. Fl. Brit. Ind. vi, 470, and in Rec. Bot. Surv. Ind. ii, 227.

DESCRIPTION.—Scandent, rather slender. *Sheathed stem* 16–18 mm. in diameter. *Leaf-sheaths* cylindraceous, elongate, densely bristly-spinulous at the mouth, greenish, apparently covered with a rusty cottony furfuraceous scurf while young, later glabrous and almost polished, rather thin, easily splitting longitudinally, each furnished with several complete, very approximate, spiculiferous collars, of which 3–4 are larger than the others, and have a broad, reversed membranous part; below each of these large reversed collars is opposed a rudimentary one, armed with spiculae pointing upwards which cross and interlace with those of the upper collar, thus forming 3–4 complete ant-harbouring galleries around each sheath; all the spiculae are extremely slender, filiform or bristle-like, brittle, blackish or often discoloured. *Leaves* cirriferous, with only five opposed pairs of very large leaflets, the pairs on each side separated by a long vacant space; petiole very long (60 cm. long, 7 mm. broad), flattened-biconvex with bluntish edges, armed at the base with a few, long, straight, deflexed spines, and higher up with small claws; the rachis on the upper surface has an acute smooth salient angle and flat side-faces which begin at the insertion of the lowest leaflets; on the under surface the rachis is armed with 3-nate claws, which become smaller on the slender cirrus. *Leaflets* papyraceous, elliptical-lanceolate, almost equally tapering to both ends, terminating in a triangular and at the sides bristly-spinulous tip: those of the lower pair are very large, 50 cm. long, 10–12 cm. broad, and have 7–8 slender but acute costae, which are all of about the same strength, and smooth on both surfaces; transverse veinlets numerous, approximate and very sharp on both surfaces; margins excessively minutely spinulous; the leaflets of the upper pair do not differ from those of the lower one, only they are smaller, 25 cm. long, 4·5–5 cm. broad, and 3-costulate. *Flowers* ...... *Fruit*......

HABITAT.—The Malayan Peninsula in the District of Perak, collected by *Father Scortechini* (Herb. Beccari).

OBSERVATIONS.—Of this Scortechini preserved only an entire leaf with a portion of the sheathed stem, apparently detached from an adult, but not yet fertile plant. If the characteristics given above are specific and not transient or variable structures, *D. macrophyllus* is easily distinguishable by its completely paired and opposed criniferous collars, and by the very few large, paired, pluri-costulate leaflets, which are quite smooth and bald on both surfaces. It seems, however, closely related to *D. Forbesii*, *D. oligophyllus* and *D. Sabut*. The leaf-sheaths in the disposition of the criniferous collars closely resemble those of *D. pseudo-mirabilis*.

PLATE 80.—Daemonorops macrophyllus *Becc.* It represents the type specimen in Herb. Beccari.

75. **DAEMONOROPS GENICULATUS** Mart. Hist. Nat. Palm. iii, 329 (1849); Miq. Fl. Ind. Bat. iii, 93; Walp. Ann. iii, 478 and v, 828; Hook f. Fl. Brit. Ind. vi, 470; Becc. in Rec. Bot. Surv. Ind. ii, 228; Ridley Mat. Fl. Mal. Penin. ii, 184.

Calamus geniculatus Griff. in Calc. Journ. Nat. Hist. v (1845), 67 and Palm. Brit. Ind. 77, pl. CCIIA.B.; Miquel, De Palm. Arc. Ind. 28; H. Wendl. in Kerch. Palm., 236.

DESCRIPTION.—High scandent, but flowers also when only 2–3ft. from the ground (*Scortechini*). *Sheathed stem* 2·5–4 cm. in diameter. *Leaf-sheaths* not gibbous above, armed at short intervals, especially on the upper part of the dorsum, with several sub-parallel, oblique, semi-circular or at times complete spiniferous crests or rows of deflexed or spreading spines united by their bases into membranous rings; the spines are mostly large, unequal, 2–4 cm. long, thinly laminar and blackish; intermingled with these spines are slender, brittle, needle-like or setiform spiculae; the parallel rows of spines, as a rule, descend obliquely from the rim of the mouth and surround the dorsum of the sheath; some of the lower rows, however, are completely encircling; the mouth is very oblique, and is densely armed with long and narrow ascendent spines of which some are as much as 10–15 cm. in length. *Ocrea* inconspicuous. *Leaves* large, elongate, 1·1–1·5 m. long in the pinniferous part, and terminating in a strongly-clawed cirrus, about as long; petiole elongate, usually 30–40 cm. in length but in vigorous leaves, especially in those of the lower part of the stem, as much as 60–80 cm., robust, up to 15 mm. broad near the base where it is plano-convex; higher up it is slightly flattened-biconvex, or convex beneath, and obsoletely angular above, conspicuously and rather closely armed on the very obtuse edges with very long, erecto-patent, rigid, straight, spiky, woody spines that are frequently accompanied, at their bases, by others shorter and divergent or digitate; the longest spines are those near the base, which are as much as 15–18 cm. long, and become gradually shorter higher up, where they are sometimes transformed into digitate, hooked prickles; on the upper surface the petiole is sparsely and minutely prickly, the prickles being often approximate in small series; the dorsum of the petiole is smooth, especially at its base; the rachis in the lower portion of the upper surface has an obtuse salient angle, and is more or less deeply grooved at the sides, higher up the salient angle becomes acute with flat faces; it is smooth all over; on the under surface the rachis is armed with 3-nate, or 5–7-nate black-tipped claws. *Leaflets* rather numerous, very inequidistant, more or less distinctly approximate into several groups formed each of 5–7 leaflets, on each side of the rachis, the groups on one side being subopposite, or shortly alternate with those of the other side; in each group the leaflets are all in one plane, almost equidistant, and 2–4 cm. apart; the vacant spaces between the different groups vary from 3 to 15 cm.; the leaflets are rather firmly papyraceous, green, paler beneath, narrowly lanceolate or ensiform, broadest about their middle, and thence tapering somewhat to a not very acute, but suddenly plicate base, and gradually narrowing above to a subulate and finely caudate bristly tip; on the upper surface the leaflets have the mid-costa acute, remotely spinulous or quite smooth, and several unequal slender and smooth secondary nerves; on the under surface usually 3 but not unfrequently 5 and at times 7 nerves are more or less unequally furnished with spinulous or very short bristles; transverse veinlets very numerous, but usually not very distinct; margins inconspicuously, remotely and appressedly spinulous; the lower margin has a rather distinct bristly indentation not very far below the caudate apex; the lower and intermediate leaflets are 30–40 cm. long, 20–30 mm. broad; the upper are not much smaller. *Male spadix* erect, rigid, elongate, terete, acuminate before flowering: when in flower it has a rather dense supradecompound cupressiform panicle, which in vigorous specimens attains 40–60 cm. in length, and is supported by a peduncular part as long or even longer; the latter is flattened, narrows slightly towards the base, has smooth surfaces, and not very sharp edges, which are usually smooth at their bases, but are more or less powerfully armed in the remainder; in some specimens the spines are solitary, very strong and up to 4–9 cm. long, slightly deflexed and regularly disposed, in others they are fascicled, of unequal length but short, and digitate-divaricate or at times almost obsolete; primary spathes thin, papyraceous, exsuccous, covered when young with a fugacious, soft, furfuraceous scurf: they split easily longitudinally, are open and rather flat during the anthesis and soon deciduous; the outermost spathe is narrowly lanceolate and acuminate, it has two slender keels on the outer dorsal surface, which usually carry, at regular intervals, several tufts of very weak, slender, and long, non-pungent, subspiny bristles; these same bristles occur also on the ventral side along the line of opening of the spathe; further the surface between the keels and especially towards the upper end is not infrequently covered with short, scattered, comb-like series of black spiculae; the inner spathes are very narrow and acuminate, each gradually protruding beyond that immediately below; only the lower are bristly along the centre of the dorsum towards the apex; the axial parts of the panicle are densely furfuraceous when young, and glabrescent afterwards; the main axis of the spadix is slightly flattened, and obsoletely and irregularly armed; the partial inflorescences are 5–7 in number; secondary and tertiary spathes bracteiform, produced at one side into a triangular exsuccous acuminate point; partial inflorescences ovate in outline, strongly callous in their axillas, erecto-patent, 12–17 cm. long, with 3–5 gradually shorter spreading branchlets; the lowest of these is the largest, 6–7 cm. long, and carries 4–6 spikelets on each side; the others are shorter and with fewer spikelets; both branchlets and spikelets are conspicuously callous in the axilla; the spikelets are spreading, flattened, comb-like, 2–3 cm. long, 10–11 mm. broad, and carry, perfectly bifariously, 20–25 contiguous flowers on each side; spathels bracteiform, horizontal or slightly deflexed, broadly and shallowly cymbiform, acute; the apex not or very slightly protruding beyond the involucre which is deeply cupular, truncate, entire and tomentose at the base like its spathel. *Male flowers* elongate, linear, terete, obtuse, sometimes slightly curved, 4–5 mm. long and only about 1 mm. thick; the calyx tubular, striately veined, with 3 superficial and rather obtuse teeth; the corolla finely striately veined, about twice as long as the calyx, parted down almost to the base into 3 linear segments; filaments of the stamens filiform, free from the base, and with inflected apices; anthers versatile, linear, with the cells slightly disjunct in their basal part, obtuse at both ends: rudimentary ovary with a short cylindrical basal part, and 3 long linear rod-like stigmas, which attain to or even surpass the middle of the corolla. *Female spadix* very similar to the male one as to the general dimensions of the spathes, the peduncular part, and the number of partial inflorescences but quite different as to the flowers; the lowest partial inflorescences are 15–20 cm., long, have also a very short (15–20 mm. long) plano-convex peduncular part, a rather thick angular axis which has very short internodes, and only 3–5 spikelets on each side; the spikelets are 8–12 cm. long, the upper ones somewhat shorter, are spreading on account of a very conspicuous axillary callus, and carry distichally 4–7 flowers on each side; their axes are slender, angular, conspicuously flexuose, the joints between each flower being strongly curved (not zig-zag sinuous with straight joints); spathels very shortly and rather loosely asymmetrically infundibuliform, produced at one side into a triangular membranous point; involucrophorum, distinctly callous at its axilla, sometimes, especially in the lower part of the spikelets, very shortly pedicelliform, obconical and obliquely calyciform, narrowing towards the base, but most frequently sessile in its spathel, slightly produced, but bluntish at one side, and with the other side embracing the base of the neuter flower; involucre very obliquely cupular, slightly protruding beyond the involucrophorum, especially on the side of the neuter flower, of which the areola is very distinct, ovate or suborbicular and niche-like, sharply bordered, the scar not callous. *Female flowers* 6–7 mm. long and rising from an ovoid base, narrow towards the apex; the calyx ovoid-urceolate, finely striately veined, with 3 very superficial bluntish teeth; the corolla about as long as the calyx, ventricose and undivided in its lower half, the segments lanceolate; staminal urceolum almost entirely united to the corolla, and crowned by 6 very short, thickish, triangular, subulate teeth; anthers linear, somewhat shorter than the segments. *Fruiting perianth* almost explanate or very shortly pedicelliform on account of the callous base of the calyx. *Fruit* broadly ovoid-elliptical, or globular-ovoid, 20–22 mm. long including the perianth and mucro, and 15—18 mm. broad; very suddenly terminated by a slender, 2–3 mm. long beak; scales in 15 longitudinal series, glossy, slightly broader than long, grooved along the centre, of a dirty straw-colour, with a very narrow, uniform, red-brown or very dark marginal line; the margin itself is very narrowly scarious, finely erosely toothed, the point very shortly produced, obtuse. *Seed* sub-globular or slightly oblong, minutely pitted and tubercled; the chalazal fovea punctiform, inconspicuous; albumen densely ruminated; embryo basal.

HABITAT.—Pulo Pinang (*Griffith*). In the continental part of the Malayan Peninsula it seems common in the district of Perak, where it was collected on Gunong Tambang Batak (*Scortechini* No. 301^b in Herb. Beccari) and in the same district by *King's collector* (No. 7849), at Goping (No. 576), at Larut (No. 2735 and 2931); by *Ridley* on the Thaiping Hills (No. 11409 in Herb. Calcutt. and Beccari.), at Bujong Malacca (No. 9813 in Herb. Calcutt. and Beccari.). In Selangore at the 15th mile, Pahang Track (*Ridley* No. 8778 in Herb. Calcutt. and Beccari.). State of Pahang, Kuala Lepis (*Machado* No. 11635 from Ridley in Herb. Beccari.).

OBSERVATIONS.—A very distinct, but rather variable, species, allied to *D. verticillaris*. The male spadix is almost identical in the two species and the spikelets of both are more similar to those of a *Calamus* than to those of the greater number of *Daemonorops*, and indeed they closely resemble the spikelets of the species of the group of *C. palustris*.

Though externally the male spikelets of *D. verticillaris* and *D. geniculatus* are very similar, their flowers are widely different internally, as those of the first have the stamens inserted about midway down the corolla, and have at the sides and at the base of each filament a fleshy globular nectariform body, while in *D. geniculatus* the stamens are inserted in the bottom of the corolla and are devoid of these special nectariform bodies. *D. geniculatus* also differs considerably from *D. verticillaris* in the armament of the spathes and leaf-sheaths, these last in *D. geniculatus* not offering such perfect contrivances for harbouring ants as in the other.

D. geniculatus varies in the length and armament of the petiole, and of the peduncular part of the spadix, in the degree of spinescence of the primary spathes, in the number of bristles on the nerves on the under-surface of the leaflets, in the more or less distinctly pedicelliform involucrophorum, and in the shape and size of the fruit.

In Ridley's No. 8778 from Selangore the completely mature fruit is somewhat larger than usual, ellipsoidal, 25 mm. long (including the perianth and beak) and 19 mm. broad; the seed is globose-ovoid, 14 mm. long, 12 mm. broad. Ridley in the "Materials" l. c. apparently considers *D. geniculatus* as different from the plant diagnosed in Hook. f. Fl. Brit. Ind. vi, p. 470, for after citing it he adds the word "partly." Perhaps Mr. Ridley supposes that the male flowers attributed in the "Flora of British India" to *D. geniculatus* are not its own, but I am quite certain that they really belong to it, although very similar to those of *D. verticillaris*, as already stated above. I have been able to ascertain this fact by numerous Herbarium specimens, and also by the manuscript notes and drawings of *D. geniculatus* and *D. verticillaris*, made by the late Father Scortechini on the living plants in their native country.

PLATE 81.—Daemonorops geniculatus *Mart.* An intermediate portion of a leaf (under-surface); portion of a sheathed stem with an entire spadix in fruit: from Scortechini's specimen No. 3016 in Herb. Beccari. Partial inflorescence with growing ovaries (in the upper part of the plate); from No. 7849 in Herb. Calc.

PLATE 82.—Daemonorops geniculatus *Mart.* Base of the petiole and upper part of a leaf-sheath; an intermediate portion of a leaf (under-surface); an entire male spadix; an isolated outer spathe. From a specimen collected by Scortechini in the District of Perak (Herb. Beccari).

76. **Daemonorops cristatus** Becc. nelle Foreste di. Borneo, 608, and in Rec. Bot. Surv. Ind. ii, 228.
D. diversispinus Becc. in Rec. l. c. 229 (only as to the spadix).

Description.—Scandent, rather slender. *Sheathed stem* 13–14 mm. in diam. *Leaf-sheaths* rusty-brown furfuraceous, not or very slightly gibbous above, very unequally and irregularly armed, especially on their lower and dorsal part, with rather large, very thinly laminar, deflexed, scattered spines, and with several short series of very small, crinitorm, black, ascendent spiculae; near their mouths and also at the base of the petiole, on the anticous aspect, the spines grow thicker and longer, and more slender, sometimes criniform, point in opposite directions, up and down, and are united by their bases so as to form a few membranous crests, which occasionally give shelter to colonies of ants. *Leaves* elongate, about 1 m. long in the pinniferous part, and terminating in a slender clawed cirrus; petiole about 25 cm. long, glabrous, polished, plano-convex near the base, slightly biconvex in its upper part, the edges acute, and armed near the base on the upper surface with long (up to 4–5 cm.) very thinly laminar, narrow, subulate, straight, rather densely set spines, and on the intermediate portion with short prickles, the uppermost portion being unarmed; underneath, the petiole is smooth, or has only a few prickles near the base where it is armed with a line of long straight approximate spines and small remote claws higher up; the rachis in its lower portion is convex above, and has a narrow and deep groove on each side for the insertion of the leaflets; in the intermediate portion it is armed underneath, along the centre, with small solitary claws, which become ternate only towards the upper end and on the cirrus; on the upper surface the rachis is smooth and has an acute salient angle and flat side-faces; leaflets numerous, equidistant, 2–3 cm. apart, broadly linear-lanceolate or linear-ensiform, 27–28 cm. long, and 12–15 mm. in width, broadest about the middle, and thence tapering almost equally towards both ends, or gradually acuminate to a filamentous and bristly tip, and to an acute base, green on both surfaces, but paler beneath; on the upper surface the mid-costa is very slender and glabrous, slightly decurrent at its base along the salient angle of the rachis; there is also one slender secondary nerve on each side of the mid-costa which is occasionally furnished with a few black bristles, but otherwise is quite smooth; underneath, the leaflets are densely bristly-spinulous on 5 nerves, but more closely on the mid-costa; transverse veinlets numerous, translucent and sharp on both surfaces; margins not very appressedly yet closely ciliate-spinulous. *Male spadix* before flowering erect, slender, cylindraceous, as thick as a man's little finger, acuminate; primary spathes about 6, thinly papyraceous, exsuccous, brown and dull on both surfaces, all quite unarmed, glabrous, finely striately veined externally, linear-lanceolate, acuminate, tubular before the anthesis, but soon split longitudinally on the ventral side; the outermost rather acutely two-keeled, 25 cm. long; the inner spathes do not protrude much beyond each other and are acutely keeled at the apex; the flowering panicle is strict, cupressiform, has about six partial inflorescences, is about 40 cm. long and is supported by a flattened peduncular part about 20 cm. long, 7–9 mm. broad, with very acute edges that bear a few flabby spiculae; the partial inflorescences are covered by an abundant rusty-furfuraceous down, are flattened, appressed to the main axis, ovate in outline and divided into several gradually diminishing branchlets; of these the lowest carry distichally 5–6 spikelets on each side; secondary spathes very small, embracing, produced at one side into a small, elongate, triangular, acute point; the spikelets are flat, 15–20 mm. long, 6–7 mm. broad, have (8–12) quite flatly bifarious, contiguous flowers on each side, their axes strongly and closely zig-zag sinuous at each flexure; spathels extended at one side into a broad, triangular point, which subtends the flower; involucre orbicular, shallowly cupular, entire, shorter than its spathel. *Male flowers* ovoid, obtuse, 3·5 mm. long; the calyx campanulate, slightly 3–toothed, finely striately-veined. *Female spadix* has a rather diffuse, ovate panicle (30 cm. long in one specimen) borne by a very long (50 cm.) peduncular part; the outermost spathe is long, persistent, narrowly lanceolate, 25 cm. long, 2·5 cm. broad, smooth, except for a very few inconspicuous bristly spinules on the keels; its peduncular part is flattened, plano-convex and has sharp, almost narrowly-winged edges; it is 8 mm. broad at the upper end and narrows slightly towards the base, where the edges are armed with a few long, very slender spines; the axial parts are more or less fugaciously rusty-furfuraceous; the main axis is very rigid and straight, acutely angular and has four partial inflorescences; these are erect, 10–15 cm. long, appressed to the main axis and have a very few (4–5) loose, spreading, long spikelets; secondary spathes bracteiform with a very short annular part and extended at one side into a small, triangular, finely subulate, embracing limb; the axes of the inflorescences are slender (not thicker than those of the spikelets) angular, slightly sinuous, spikelets elongate; slender, 8–10 cm. long, and with 4–6 bifarious ascendent flowers on each side; spathels thinly membranous with a very short tubular part, extended at one side into a triangular, very finely acuminate limb; involucrophorum erecto-patent, callous at its axilla, pedicelliform, angular, 2–4 mm. long, very obliquely extended at one side into an ovate very obtuse limb; involucre very shallowly concave or pateriform, very obliquely subtended by the involucrophorum, produced externally into a sub-pedicelliform and callous stalk, upon which rests the neuter flower. *Female flowers* 6 mm. long; the calyx campanulate, broadly 3-toothed, finely striately-veined, membranous, with a callous base; the corolla not quite twice as long as the calyx; the segments rather broadly triangular, bluntish. *Fruiting perianth* obconical. *Fruit,* while still young, ovoid with a conic acute tip; scales arranged in 18 longitudinal series.

HABITAT.—Borneo; on Mount Mattang near Kuching in Sarawak (P. B. No. 1925, male plant). Collected also by *Lobb,* probably also in Sarawak (female plant in Herb. Calcutt.). Malayan name in Sarawak, "Rotang Taradan."

Recently it has been found again in Sarawak by *Hewitt* with male spadices in flower (Herb. Kew.).

OBSERVATIONS.—It is a very peculiar species, easily distinguishable by its quite unarmed, narrow, membranous spathes, and by the extraordinarily oblique position of the involucre, which is laterally prolonged into a distinct callous pedicel for the support of the neuter flower.

The specimen collected by me bears only an unopened male spadix, and Lobb's has a spadix with very young fruit. The two spadices on first inspection appear quite different; but the outermost spathes of both are quite identical, and moreover the leaf which accompanies Lobb's specimen agrees in every particular with that of the male plant.

In the Calcutta Herbarium, the parts belonging to *Daemonorops cristatus* and *Calamus ferrugineus*, both collected by Lobb in Borneo, had been mixed together, and the spadix of one was glued on the same sheet with the leaves of the other, and *vice versâ*. On account of this shifting of parts, I have described in the Records of the Botanical Survey of India a *Daemonorops diversispinus*, which must be eliminated, being established upon the female spadix of *Daemonorops cristatus* and the leaves of *Calamus ferrugineus*. Further material forwarded from Calcutta, after the publication of my paper on *Calamus* in the "Records," has enabled me to recognise the error.

PLATE 83.—Daemonorops cristatus *Becc.* Portion of the sheathed stem with an entire leaf and a male spadix before the anthesis; from P. B. No. 1925 in Herb. Beccari.

PLATE 84.—Daemonorops cristatus *Becc.* Base of a leaf and upper portion of a leaf-sheath; an entire spadix with very young fruit; upper end of a leaf. This is the spadix described by me (Rec. Bot. Surv. Ind. ii, 229) as that of *D. diversispinus*, from a specimen collected by Lobb in Borneo (Herb. Calcutt.).

77. **DAEMONOROPS ACANTHOBOLUS** Becc. in Rec. Bot. Surv. Ind. ii, 228.
D. geniculatus var. *sphaerocarpus* Becc. in Rec. Bot. Surv. Ind. ii, 228.

D. accedens (non Bl.) Miq. Prod. Fl. Sum., p. 256.

DESCRIPTION.—Not scandent. Stem erect, short. *Leaf-sheaths* 2·5 cm. in diameter, rusty-furfuraceous, not gibbous above, very obliquely truncate at the mouth, armed and ornamented, especially on the upper part of the dorsum, with a few sub-parallel, oblique, semi-circular, spiniferous, deflexed, membranous crests, formed by the confluent bases of a few, very long (as much as 6–7 cm.) light coloured, flat, narrow, very acuminate spines, and by numerous, small, brown spiculae filling the spaces between; the mouth obliquely truncate, setigerous on the ventral side. *Ocrea* inconspicuous, glabrous. *Leaves* elongate, 1·5–1·7 m. long in the pinniferous part; very shortly cirriferous or terminating in gradually smaller and abortive leaflets; petiole at first fugaciously furfuraceous, later almost polished, robust and elongate, 50–70 cm. long, 12–14 mm. broad, concave on the upper surface at its base only, then plano-convex, and from the middle upwards unequally biconvex, *i.e.*, more convex on the lower than on the upper surface, armed on its lower part almost regularly, and at rather short intervals, on the not very acute edges, with extraordinarily long, straight, very rigid or woody, very acuminnate, erecto-patent, spiky spines, each of these often accompanied at their bases by 1–2 smaller and divergent spines; higher up the spines are shorter, horizontal or deflexed; the upper surface and the dorsum are smooth; rachis in its lower portion armed, beneath, on the sides, and along the centre, with small solitary claws, which become 3-nate higher up and occasionally 5-nate on the sub-cirriform upper end; on the upper surface the rachis is smooth all over: in its lower portion it is convex, and has broadly grooved side-faces wherein the leaflets are inserted, while higher up comes an acute, salient angle and flat or slightly concave side-faces; leaflets very numerous, equidistant, 2·5–3 cm. apart, rather firmly papyraceous, green and almost glossy above, paler beneath, ensiform or very narrowly lanceolate, usually broadest below their middle, and thence tapering towards a rather acute base, gradually acuminate above to a finely subulate and, at the apex, bristly tip; on the upper surface the mid-costa is very slender but very sharp, and has a few bristles only towards the apex. The secondary nerves are smooth and very slender, so that the upper surface is not or only very indistinctly 3-costulate; on the under surface the mid-costa is very minutely and very closely ciliate, and one slender nerve on each side of it is also occasionally and sparingly bristly-spinulous; transverse veinlets very numerous, continuous, and very sharp on both surfaces; margins smooth near their base, spreadingly ciliated from the middle upwards, the lower margin on the upper surface very minutely pitted when seen under a lens; the intermediate leaflets are 25–30 cm. long, and 17–20 mm. broad. *Male spadices* 40–55 cm. long, including a pedicellar part 20 cm. in length, slender, flattened, softly furfuraceous, slightly broadening in the upper part, armed on the margins with slender spines, which are deflexed in prefloration, but afterwards are ascendent; primary spathes concave, narrowly elliptical-cymbiform, acuminate, gradually tapering towards the base, firmly papyraceous, of an hazel-nut-brown colour, glabrous and finely striate internally, furfuraceous externally and more or less furnished on the back with light-coloured, flabby, transversely seriate bristles; the outermost spathe is longer and narrower than the inner, and each of the latter gradually protrudes beyond that immediately below it; the flowering panicle when not quite free from the spathes is slender and strict, later the partial inflorescences are spreading, but they are all scantily flowered; partial inflorescences about 6 in number, the lower are the largest, 10-12 cm. long and are divided into 3–4 branchlets, which carry only 5–6 spikelets in all; secondary spathes small, bracteiform, prolonged at one side into a broad triangular membranous point; the lowest spikelets are about 15 mm. long, have 5–7 flowers in all, and are densely covered with a soft cottony-furfuraceous, rusty scurf; their axes are thickish, zig-zag sinuous; spathels very shortly, widely and asymmetrically infundibular, produced at one side to a broad, triangular, bluntish point; involucre cupular, rather deep, entire, or obsoletely posticously bidentate, on a level with the involucrophorum or slightly shorter. *Male flowers* oblong, comparatively large, 7–8 mm. long, 2·5–3 mm. in diameter, obsoletely trigonous, bluntish, often slightly curved; the calyx campanulate, shortly and broadly 3-toothed, faintly striately-veined; the corolla two and a half times as long as the calyx, smooth externally. *Female spadix* more or less persistently rusty-furfuraceous, erect, rigid, forming a rather elongate, narrowly ovoid, acuminate panicle, borne on a strongly flattened, acutely two-edged, quite unarmed, peduncular part; one specimen has this peduncular part 35 cm. long, 1 cm. broad at the upper end, and somewhat less at the base, with a flowering panicle 75 cm. long, carrying about 9–10 partial inflorescences; of the latter the uppermost are, however, small and rudimentary; the main axis is straight, irregularly angular, not swollen at the nodes; the lower partial inflorescences are the largest, 16–18 cm. long, erecto patent, kept spreading by a rather distinct axillary callus, have a short (10–15 mm. long) plano-convex pedicellar part, and 5–6 distichous spikelets on each side; secondary spathes thinly membranous, brittle, exsuccous or scarious, embracing, broadly triangular, acuminate; spikelets erecto-patent, the lower 7–8 cm. long, with 5–6 bifarious flowers on each side; the upper somewhat shorter and with fewer flowers; their axis flexuous, and more or less covered with a rusty scurf detaching in flakes; the joints between two flowers curved; spathels very thinly membranous, reddish, brittle, shortly annular, and loosely embracing, produced at one side into a very broad triangular and acute point; involucrophorum obconical, usually distinctly pedicelliform in the basal part of the spikelets, and almost sessile at the upper end; the limb membranous sub-infundibular, and, at one side, slightly produced; involucre irregularly cupular, more or less unilaterally evolute; areola of the neuter flower concave, niche-like, sharply bordered, oblong or sub orbicular, the scar not swollen. *Female flowers* narrowly ovoid, 5 mm. long; the calyx campanulate, obsoletely 3-toothed, but soon irregularly split, with a callous base; the corolla not quite twice as long as the calyx, and like it not distinctly veined externally; staminal urceolum conical and free in its upper part where crowned with 6 triangular teeth; the upper part frequently carried up with the growing ovaries to form a muff-like sheath to the beak of the young fruit *Fruiting perianth* almost explanate. *Fruit* spherical, 16–17 mm. in diameter, sometimes very slightly depressed on the top, shortly and abruptly beaked; scales in 15 longitudinal series, grooved along the centre, dull, of a dirty-straw colour, at times tinged with red but not resiniferous, with a darker, very obtuse point, and the margins very minutely, but distinctly, erosely-toothed. *Seed* globular, 10 mm. in diameter, finely tubercled and pitted, its raphal side slightly ventricose; chalazal fovea indistinct, punctiform; embryo basal.

HABITAT.—N.E. Borneo, in Sarawak near Kuching (*Beccari* P. B. No. 22) and at Mattang (*Hewitt* in Herb. Kew.—male plant); a specimen of the male plant was also collected in the wet forests of Borneo by *Lobb* (Herb. Kew. without a special locality). S.E. Sumatra at Muara Enim in the interior of the Residency of Palembang (*Teijsmann* No. 3581 in Herb. Hort. Bot. Bog. of Calcutta). Vernacular name in Palembang dialect "Houe kouro ràc (Teysmann)."

OBSERVATIONS.—*D. acanthobolus* is related to *D. geniculatus* and especially to *D scapigerus*; the armament of the leaf-sheaths of both is very similar; but the branching of the female flowering panicle is widely different, being contracted and with few branches in *D. scapigerus*, and elongate, much branched, ovoid-cupressiform, and acuminate in *D. acanthobolus*. In Lobb's specimen the leaves are said to be 8–9 feet in length; they terminate in a very slender rudimentary cirrus.

In Hewitt's male specimen the spadix is smaller than in that of Lobb; the panicle is 22 cm. long, supported by as long a peduncular part; the partial inflorescences are 6–7 in number and the largest are only 4-5 cm. long; no differences in the flowers; the outermost spathe has tufts of bristles only on the keels.

This is certainly the *Daemonorops* reduced by Miquel (Prodr. Fl. Sum. l. c.) to *D. accedens* of which he also writes in the Journ. de Bot. Néerl. 21, for I have seen the specimens examined by Miquel.

PLATE 85.—Daemonorops acanthobolus *Becc.* The base of the petiole (front view); upper portion of a leaf-sheath and base of the petiole with a spadix *in situ* bearing young fruits; an intermediate portion of a leaf (under surface). From the type-specimen P. B. No. 22 in Herb. Beccari.

PLATE 86.—Daemonorops acanthobolus *Becc.* Male spadix in flower; lower portion of a petiole. From Lobb's specimen in the Kew Herbarium.

78. DAEMONOROPS SCAPIGERUS Becc. in Rec. Bot. Surv. Ind. ii, 228.

DESCRIPTION.—Not scandent. *Stem* erect, short. *Leaf-sheaths* 20–22 mm. in diameter, rusty furfuraceous, not gibbous above, very obliquely truncate at the mouth, armed and ornamented, particularly on the upper part of the dorsum, with a few subparallel, oblique, semi-circular or almost complete, spiniferous, deflexed crests or rows of small, flattened, usually spiculiform spines, which are united by their bases into narrow membranous rings. *Leaves* elongate, 0·8–1 m. long in the pinniferous part, terminating in a slender, often short, and rudimentary cirrus; petiole at first fugaciously furfuraceus, later almost polished, elongate, 35–40 cm. long. 6–8 mm. broad, broadly grooved at the base, then for a short distance plano-convex, and from the middle upwards flattened–biconvex, smooth on both surfaces; the margins rather obtuse, strongly spinous; the spines light-coloured, those nearer to the base very long (up to 8–11 cm.), erect and spreading, gradually shorter higher up, frequently geminate and at times ternate, one longer than the others and divaricate; rachis armed on the under surface with at first solitary and higher up ternate, rather small claws; on the upper surface it has a salient, smooth angle, obtuse at first, very acute from the middle upwards; leaflets rather numerous, equidistant, 3–6 cm. apart, except those in the terminal part where the intervals are longer and somewhat unequal; rather firmly papyraceous, green, paler beneath, narrowly lanceolate or ensiform, broadest about or a little below the middle and thence tapering to a rather acute base and gradually acuminate to a finely subulate bristly tip, plicate on the upper surface; the mid-costa is very slender, acute and very sparingly spinuliferous only near the apex; the secondary nerves unequal, quite smooth, one on each side of the mid-costa very slightly stronger than the others, but not enough to render the upper surface distinctly 3-costulate; on the under surface the mid-costa alone minutely and remotely spinulous; transverse veinlets excessively numerous, approximate and short, so as to render both surfaces when seen under a lens finely shagreened; margins smooth or very remotely minutely appressedly spinulous towards the apex; the largest leaflets are those a little above the base, 35–40 cm. long, 22–25 mm. broad; the upper ones somewhat shorter but not narrower. *Male spadix* . . . *Female spadix* has a very short, slightly branched and rather dense panicle, borne on a very long peduncular part; primary spathes membranous, exsuccous, splitting longitudinally, concave-cymbiform, lanceolate, acute, deciduous after the anthesis, about 10 cm. long, quite unarmed; the flowering panicle ovate in outline, 15 cm. long, with only 4 partial inflorescences, including the terminal one; all the axial parts covered with a cottony, more or less permanent, rusty-brown scurf; the main axis zig-zag sinuous, with short (2–5 cm. long) flattened internodes; the first and second of these sometimes prickly; the peduncular part very long and slender—in one specimen 40 cm., in another 1·15 m. long—strongly flattened, biconvex, and more or less acutely two-edged, very gradually broadening towards the upper end, being at the base 4–5 mm., and at the end 1 cm. broad; it is more or less permanently furfuraceous, and in its lower part armed on the margins with long, pale, straight, slender, erecto-patent, solitary or 2–3-nate spines, which have a distinct axillary callus and a transverse rima; higher up the spines become shorter and closer all round the axis and are fascicled–digitate or divergent, very unequal and with thick swollen confluent bases; partial inflorescences short, divaricate, 4–8 cm. long, with thickish axes and only 2–3 spikelets on each side; secondary spathes comparatively large, membranous, exsuccous, reddish–brown, finely striate, embracing the base of the spikelets, broadly ovate, acute or acuminate; spikelets very short (15–20 mm. long), thickish, with very few (5–6) bifariously set assurgent flowers; spathels comparatively large, very broadly obliquely infundibular, tomentose at the base, produced at one side to a broad triangular subacute point that surpasses the involucre; involucrophorum cupular, immersed in its spathel, subtending at one side the base of the neuter flower; involucre obliquely cupular or more evolute on the side of the neuter flower, immersed in and slightly longer than the involucrophorum; areola of the neuter flower niche-like; the scar not swollen. *Female flowers* about 1 cm. long; the calyx campanulate obsoletely 3-toothed, soon split down almost to the base into 3 parts; corolla twice as long as the calyx, parted down to a little past the middle into 3 triangular, acute, thinly coriaceous segments; calyx and corolla not distinctly striately–veined externally; staminal urceolum free and conical in its upper part, which is crowned by 6 triangular acute teeth and after the anthesis is carried up with the growing ovaries and later sheaths the beak of the young fruit like a muff; fruiting perianth broadly obconical, callous at its base. *Fruit* (immature) globose-ovoid, surmounted by a stout, black, conical beak. *Scales* in 13–15 longitudinal series slightly grooved along the middle, of a straw-yellow colour with a rather broad black marginal line; the margins extremely narrowly scarious and almost inconspicuously erosely–toothed.

HABITAT.—Borneo: near Kuching in Sarawak. (*Beccari* P. B. No. 22); in Sarawak; found also by *Lobb* in 1857 (Herb. Kew.).

OBSERVATIONS.—A very peculiar species on account of its very short flowering panicle borne on an extraordinarily long pedicellar part. Lobb's specimen in Herb. Kew. is only a female spadix with growing ovaries and with two primary spathes still attached to it; my specimens have the fruit more advanced towards maturity and the spathes have fallen.

PLATE 87.—Daemonorops scapigerus *Becc.* Upper end of a leaf; 2 spadices with almost mature fruits; portion of a sheathed stem with the petiolar part of a leaf; from the type specimen P. B. No. 22^{bis}. in Herb. Beccari.

DAEMONOROPS SCAPIGERUS var. MINOR Becc. in Rec. Bot. Surv. Ind. ii, 229.

DESCRIPTION.—Stem about 60 cm. high (Lobb). *Leaves* . . . *Female spadix* excessively slender; the peduncular part in two specimens is 40 cm. long, filiform, slightly flattened, covered with a cottony easily removeable indumentum; at the base it is broad 1·5 cm., at the apex 4 mm.; on the upper part it carries only a few short horizontal spines on the margins; the flowering panicle is very short, 4–5 cm. in length, and has 3–4 short partial inflorescences, each bearing 5–6 flowers in all; primary spathes during the anthesis spreading and embracing the small inflorescences, lanceolate, concave, cymbiform, membranous, exsuccous, rusty furfuraceous, not keeled externally and entirely unarmed; in the fruiting spadix they are lacerated and almost destroyed; secondary spathes and other appendicular parts as in type. *Female flowers* 8 mm. long, exactly as described above down to the peculiarities of the staminal urceolum. *Fruit* globose, 17 mm. in diameter, suddenly narrowing to a conspicuous, black, stout, conical beak; scales in 15 longitudinal series, grooved along the centre, regularly rhomboidal, the largest 6 mm. broad, somewhat broader than long, of a straw-yellow colour, with very dark marginal line, the point obtuse, the margins very acute, almost entire. *Seed* globular, 12 mm. in diameter; albumen deeply ruminated; embryo basal.

HABITAT.—Borneo: Sarawak, *Lobb* (1857) in Herb. Kew.

OBSERVATIONS.—I have seen only two spadices, the one in flower, the other in fruit, of this plant which seems to me only a variety of *D. scapigerus*, although at first sight the spadices of the two may appear widely different on account of the very slender and almost unarmed peduncular part in the variety *minor*, and of its very short and scantily flowered panicle; but in the characters of the flowers and of the appendicular parts, I have not been able to discover any appreciable difference between the typical form and the variety.

79. DAEMONOROPS PERIACANTHUS Miq. Prod. Fl. Sum. 256 and 593 (1860), and in Journ. Bot. Néerl. i, 20; Teijsm. Cat. Hort. Bog. 74; Becc. in Rec. Bot. Surv. Ind. ii, 229.

Calamus (sect. *Dæmonorops*) *periacanthus* Miq. De Palm. Arc. Ind. 22 and 28; H. Wendl. in Kerch. Palm., 237.

Daemonorops dissitophyllus Becc. Nelle Foreste di Borneo (1902) 608, and in Rec. Bot. Surv. Ind. ii, 229; Ridley Mat. Fl. Mal. Penin. ii, 183.

Rotang periacanthus **Baill. Hist. de Plant. xiii, 300.**

DESCRIPTION.—Scandent, of moderate size or rather robust. *Sheathed stem* 3–3·5 cm. in diameter. *Leaf-sheaths* have a small and inconspicuous gibbosity far below the base of the petiole, and are armed with comparatively few, large, light-coloured, flat, 2–4 mm. broad, 3–4 cm. long, solitary, deflexed spines, scattered amongst a large number of crowded, ascendent, dark-brown, rigid spiculae, 10–15 mm. long at most; the mouth is obliquely truncate and armed with several, erect, 8—10 cm. long, light-coloured, large spines. *Leaves* large, 2–2·2 m. long in the pinniferous part, and terminating in a robust, long, and powerfully clawed cirrus; petiole very robust, about 70 cm. long and 2 cm. broad, rather polished, in its basal portion sub-plano-convex with rather acute edges, from the middle upwards almost equally convex on both surfaces and somewhat flattened; in this portion the edges are very acute, and near them, on the lower surface, as also along the centre of the dorsum, are a few, scattered, large, strong, broadly laminar, light-coloured spines; further both surfaces, but especially the upper one, are more or less covered with small, straight, short and comparatively large, solitary or shortly seriate ascendent spines; the petiole of the lower leaves is terete and armed with remote whorls of large light-coloured spines; rachis convex and prickly on the lower portion of the upper surface, and superficially grooved at the sides for the insertion of the leaflets; from about the middle upwards the rachis is smooth, and has an acute salient angle and flat side faces; on the lower surface it is armed with very robust claws at first 3-nate, then 5-nate, and on the cirrus half-whorled at short and regular intervals. *Leaflets* numerous, all on one plane, but aggregated on each side of the rachis into several remote groups of 2–5 leaflets in each; the groups are subopposite, *i.e.*, those on one side are slightly decurrent to those on the other side; the vacant spaces are 10—20 cm. long; in each group the leaflets are sub-equidistant, 4–5 cm. apart; they are rather firmly papyraceous, closely and superficially plicate longitudinally, green, faintly glossy on the upper surface, paler and quite dull beneath, ensiform or narrowly lanceolate, broadest about their middle, tapering thence to a rather acute base, and acuminate towards a subulate, slightly bristly-spinulous tip; on the upper surface they have often a broad glossy band along the lower margin, and the mid-costa and the secondary nerves slender and sharp, of the latter one on each side of the mid-costa being somewhat stronger than the others; both surfaces are usually quite smooth, but at times the mid-costa has a few bristles underneath near the apex; the transverse veinlets are not sharp but excessively numerous, short and interrupted, and give an obsoletely shagreened appearance to both surfaces; margins almost smooth from the base up to about the middle, and thence minutely spinulous; the intermediate leaflets in large specimens are 50 cm. long and 4 cm. broad. *Male spadix* erect, rigid; the panicle 50–70 cm. in length, borne on a strongly flattened pedicellar part, which is 5–12 cm. long, 8–12 mm. broad and has a few fascicles of flabby light-coloured, black-tipped, acicular spines on the edges; primary spathes lanceolate, deciduous, thinly coriaceous, of a cinnamon-brown colour, rusty-furfuraceous externally, finely striately-veined; the outermost splits longitudinally along the entire ventral side, is two-keeled on the back, and more or less armed on the keels, with fascicles of flabby, unequal sub-bristly spinules; inner spathes smooth, each gradually protruding beyond the other; the flowering axis is slightly flexuose, more or less rusty-furfuraceous; its internodes are 7–10 cm. long, obsoletely angular, not distinctly swollen at the nodes; the partial inflorescences are 7–10 in number, spreading, rather densely panicled-pyramidate; the lowest are 10–12 cm. long and have two series of 4–5 branchlets each; the upper inflorescences speedily diminishing, while those near the apex are very small and slightly branched; the lowest branchlets have each 4–5 not quite flatly-distichous spikelets on each side; the other branchlets speedily decrease in length and number of spikelets; secondary and tertiary spathes very shortly sheathing, membranous, dry, cinnamon-brown, broad, triangular, subulately acuminate, glabrous, striately-veined; all the axial parts of the partial inflorescences are rusty and floccosly furfuraceous; spikelets short, erecto-patent, the lower of each branchlet 1·5–2 cm. long, and with 7–8 distichous approximate flowers on each side; the others shorten regularly but rapidly and have very few flowers; spathels almost without a tubular part, concave-bracteiform, produced at one side into a broad, triangular, very obtuse, spreading or deflexed point; involucre shallowly cupular, orbicular, entire or obsoletely toothed on the posticous side. *Male flowers* 5 mm. long, oblong, obtuse; the calyx cyathiform, very slightly 3-denticulate, finely striately veined; the corolla nearly thrice as long as the calyx, not, or very faintly, striate. *Female spadix* straight, erect, rigid, more or less persistently rusty-furfuraceous in every part; the flowering panicle borne on a long peduncular part, rather loosely thyrsoid, acuminate, on the average 30–40 cm. long and with 6–7, or at times fewer, speedily decrescent partial inflorescences; the main axis slightly sinuous, the internodes irregularly angular, somewhat swollen at the junctures and with a conspicuous axillary callus; peduncular part of the spadix strongly flattened and acutely 2-edged, 30–50 cm. long, 6–8 mm. broad at the base, 8–14 mm. at upper end; the edges only armed at short intervals with not very strong, often slender, rather short (10–12 mm. long at most) horizontal, solitary, fascicled, and digitate, unequal, divergent spines; smooth on the surfaces or, at times, more or less prickly; primary spathes deciduous; partial inflorescences erecto-patent or inserted at an angle of about 45°; the lowest and largest 15–18 cm. long, with 4–5 erecto-patent spikelets on each side; the others speedily smaller, and that of the apex reduced to only one scantily flowered spikelet; secondary spathes very small, annular-amplectent, produced at one side into a triangular, acuminate membranous point; spikelets kept spread by a conspicuous axillary callus, the lower the largest, 5–7 cm. long, with 5–6 distichous flowers on each side, the others are gradually smaller, their axes slightly angular, zig-zag sinuous; the spathels have a very short and broad triangular acuminate point; the involucrophorum more or less distinctly pedicelliform, obconical, flattened on the axial side, 3–5 mm. long, with a short, unilaterally evolute, infundibular, almost obtuse limb; involucre very shallowly cupular or pateriform with a rounded limb, often more evolute on the side of the areola of the neuter flower; the areola itself is concave, niche-like, sharply bordered, suborbicular or more or less depressed. *Female flowers* about 6 mm. long; the calyx cupular, very obsoletely 3-toothed, not striately veined, of a thickish texture; the corolla twice as long as the calyx; its segments elongate, triangular, rather acute, not or obsoletely veined externally. *Fruiting perianth* almost explanate with a callous base. *Fruit* spherical, 15–17 mm. in diameter, shortly beaked; scales in 15 longitudinal series, slightly grooved along the centre, of a dull hazel-nut colour with a darker intra-marginal line, the margins very finely ciliate-fringed, the point obtuse. *Seed* globular, very minutely tubercled and pitted, 9–13 mm. in diameter, finely ruminated; the chalazal fovea very small, punctiform, obsolete, placed almost in the centre of the raphal side; embryo basal.

HABITAT.—The type specimens were collected by *Teijsmann* in Sumàtra in the Residency of Palembang at Muara dua (No. 3591 Herb. Hort. Bot. Bogor.) and at Muara Enim (No. 3580, Herb. Hort. Bot. Bogor.). It grows also in the Island of Bangka at Sungei Ilan (*Teijsmann* in Herb. Hort. Bot. Bogor.); Borneo near Kuching in Sarawak (*Beccari* P. B. No. 248, and *Low* in Herb. Kew.); Labuan (*Lobb* in Herb. Kew.); Singapore at Bukit Timah (*Ridley* No. 10408 in Herb. Beccari); Johore at Tanjong Kupang (*Ridley* No. 6276 and No. 6284—male-specimen). Native names: in Sumatra at Muara dua "Rottan Udang" or "Hui urang" and at Muara Enim "Houe Landak" (Teijsmann): in Sarawak "Rotan Manis" or the sweet Rotang on account of its edible central shoot. Low gives the name: "Rotang sabut panjang duri."

OBSERVATIONS.—I have seen the type specimens of *D. periacanthus*, upon which Miquel founded the species, otherwise it would have been impossible from the description alone to recognise in it my *D. dissitophyllus*, as the description is very misleading. The type specimens of *D. periacanthus* in the Herbaria of Leiden, Utrecht and Buitenzorg consist only of spadices with mature fruit without their spathes; nevertheless Miquel describes these as "duro coriaceae" and covered with short flattened seriate prickles, characteristics which most certainly do not apply to the spathes of *D. periacanthus.*

D. periacanthus in Ridley's Mat. Fl. Mal. Pen. ii. 185, is certainly not that of Miquel; apparently it is one of the group of *D. mirabilis*, as it is described with decussating membranous spiniferous collars around the leaf-sheaths; it has the petiole armed with long spines on the edges, and the male spikelets are comb-like with very approximate flowers, like those of *D. verticillaris*, with which Ridley mistakenly believes it to have been confused in Hook. f. Fl. Br. Ind. vi, 470.

The type specimen of *D. periacanthus* numbered 3591 in the Herbarium at Buitenzorg from Muara dua, has spadix in fruit exactly corresponding in size and degree of branching to my specimen No. 248, at first considered by me as the type of *D. dissitophyllus*, only its pedicellar part is prickly not only on the edges but also on both surfaces, especially in its lower part. No. 3580 from Muara Enim of the same Herbarium, does not differ from the preceding; the fruits of both are about 17 mm. in diameter; the seed is not very regularly globular, and is slightly gibbous on the raphal side, and varies in diameter according to the place where the measurements are taken from 10 to 13 mm. Lobb's specimen in the Kew Herbarium from Labuan has a spadix in fruit; its peduncular part is strongly prickly on the edges and on both surfaces; one spathe still remains attached to the spadix, and is armed with slender, seriate, 15 mm. long (at most) spines, not only on the keels but also on the intervening surface; the fruits are spherical, 15–16 mm. in diameter; the seed is globular and 9-10 mm. in diameter. Ridley's Johore specimen No. 6276 has a more slender spadix than the preceding; the fruiting panicle is about 40 cm. long; the perfectly mature fruit is exactly spherical and 17–18 mm. in diameter; the seed is almost regularly globular and 12–13 mm. in diameter or slightly longer than broad. Bangka specimens have a small panicle borne on a slender and long pedicellar part, slightly prickly only on the edges. In Ridley's Singapore specimen No. 10408 the fruit is 15 mm. in diameter. Ridley's No. 6284 has a male spadix with panicle 70 cm. long; the outermost spathe is 15 cm. long, the second 20 cm. and more acuminate.

PLATE 88.—Daemonorops periacanthus *Miq.* Upper end of a leaf (under surface); front view of lower part of a petiole with a small portion of its leaf-sheath, an entire spadix with very young fruits: from P. B. No. 248 in Herb. Beccari. A spikelet with immature fruits, from a specimen collected by Low in Borneo (Herb. Kew.).

PLATE 89.—Daemonorops periacanthus *Miq.* Intermediate portion of a leaf (under surface); an entire spadix with quite mature fruits: from Ridley's No. 6276 in Herb. Beccari.

PLATE 90.—Daemonorops periacanthus *Miq.* Portion of a leaf near upper end (upper surface); an entire male spadix: from Ridley's No. 6284 in Herb. Beccari.

80. DAEMONOROPS VIRESCENS Becc. in Perkins, Fragm. Fl. Philipp. i, 47 and in "Webbia" i, 357.

DESCRIPTION.—Robust, scandent, 20—25 m. long. *Leaf-sheaths* armed with large robust, laminar, brown, solitary or seriate spines. *Leaves* large; petiole elongate, convex in the basal part of the lower surface, and armed along the centre of the dorsum with long spines, flat and prickly on the upper surface, higher up biconvex, armed throughout on the margins with small groups of divergent, short prickles; rachis clawed as usual on the back, acutely bifaced on the upper surface, smooth or with a spinule here and there on the salient angle. *Leaflets* numerous, inequidistant, two are often more approximate than the others but usually they are 4–6 cm. apart; they are ensiform, 40–50 cm. long, 2·5–3 cm. broad, papyraceous, rather rigid, green and subconcolorous on both surfaces, sub-3-costulate or with the mid-costa acute and the side-costae very slender, all three very sparingly bristly-spinulous near the apex; on the under surface the mid-costa alone bears short bristles from the middle upwards; transverse veinlets excessively minute and numerous, but not very distinct; margins rather closely spinulous, the lower margin on the upper surface bordered with a narrow polished band. *Male spadix*......... *Female spadix* nodding, in one specimen 75 cm. long; the panicle rather short and lax, and with only three partial inflorescences borne on a slender, 40 cm. long, flattened, acutely 2-edged and smooth peduncular part; primary spathes deciduous......(not seen by me); lowest partial inflorescences 20 cm. long, erect, with a distinct axillary callus at their insertion and with six pinnately set, gradually diminishing spikelets on each side; upper inflorescences much smaller, secondary spathes annular, sub-scarious, shortly apiculate at one side; spikelets inserted at an angle of 45° with a distinct axillary callus, rigid with a rather slender sinuous axis; the lower ones of each inflorescence are the largest and are 8–9 cm. long, and have 6–7 bifarious flowers on each side; spathels briefly annular, apiculate at one side; involucrophorum short and thick, 2 mm. long, obconical; involucre orbicular, very shallowly cupular, barely protruding beyond the involucrophorum; areola of the neuter flower with a callous scar. *Fruiting perianth* broadly obconical, shortly pedicelliform. *Fruit* ellipsoidal-ovoid, very suddenly and briefly conically beaked, 25 mm. long, 16–17 mm. broad (when nearly mature); scales in 18 longitudinal series, 11–12 in each series, almost glossy, convex, deeply grooved, of a light greenish colour with a scarious erosely toothed margin and an obtuse brownish point. *Seed* ovoid; embryo basal. The different parts of the plant, petiole, rachis spadix, and fruit retain in the herbarium a light-green colour.

Habitat.—The Philippines: in the Island of Paragua, San Antonio Bay, at about 600 m. above the level of the sea (*Merrill*, No. 868 in Herb. Manill. and Berol.)

Observations.—Very closely related to *D. longipes*, but apparently more robust, with larger leaflets and fruit; the scales are arranged in 18 longitudinal series, and each series is composed of 11–12, whereas in *D. longipes* the series are 15, and each series has only 7-8 scales; on the whole, therefore, the fruit has far more numerous scales in *D. virescens* than in *D. longipes*.

Plate 91.—Daemonorops virescens *Becc.* Intermediate portion of a leaf (upper surface); lower portion of the petiole (front view); an entire fruiting spadix; from the type specimen in Herb. Berol. (Merrill's No. 2069).

81. Daemonorops longipes Mart. Hist. Nat. Palm. iii, 205 (2nd edit. 1849), and 329 pl. 176, f. V. 23; Miq. Fl. Ind. Bat. iii, 93; Walp. Ann. iii, 478, and v, 828; Teijsm. Cat. Hort. Bot. Bogor. 1866, 74; Hook. f. Fl. Br. Ind. vi, 471; Becc. in Rec. Bot. Surv. Ind. ii, 229; Ridley Mat. Fl. Mal. Penins. ii, 184.

Calamus longipes Griff. in Calc. Journ. Nat. Hist. v, 68 (1845), and Palms Brit. Ind. 78 (excl. Rumph's cit.) pl. CCIII A.B.; H. Wendl. in Kerch. Palm. 234, excl. syn.

Daemonorops strictus Bl. Rumphia 19, pl. $\frac{163}{B}$ A; Miq. Fl. Ind. Bat. iii, 86, and in Journ. de Bot. Néerl. i, 18, and Prodr. Fl. Sum. 255; Walp. Ann. iii, 474, and v, 827.

Calamus strictus Miq. De Palm. Arc. Ind. 28; H. Wendl. in Kerch. Palm. 237.

Rotang longipes Baill. Hist. des Pl. xiii, 300.

Description.—Apparently scandent. *Leaf-sheaths* 3–3·5 cm. in diameter, thick, almost woody, not gibbous above, ultimately glabrous, very obliquely truncate at the mouth, thickly armed with stout, flat, elastic, scattered or subseriate, but individually distinct, brown, schistaceous spines which are broader than usual (4–6 mm. broad, 5–6 cm. long); those along the margins on the ventral side are more slender but not longer; those at the base of the petiole on its margins are subulately triangular and rather longer than any of the others. *Ocrea* very short, almost reduced to a simple semi-annular margin, but very densely covered with minute blackish bristles; the same kind of covering extends along the ventral suture of the sheath where often the bristles are arranged in crowded transverse series. *Leaves* large, 1·5–2·4 m. long in the pinniferous part, terminating in a long and strongly clawed cirrus, the latter at times rudimentary or wholly wanting in the leaves of the lower part of the stem; petiole glabrous and almost polished, more or less elongate, robust, 30–60 cm. long, 14–18 mm. broad at the base, where broadly grooved on the upper surface; above the base it becomes biconvex and somewhat flattened; margins obtuse, armed at the base with long, rigid, robust, irregular spines which higher up are reduced to short, distant, straight teeth; the upper surface of the petiole is smooth; the under surface is armed along the centre at the base with a line of straight, long, deflexed spines, which higher up are gradually reduced in size and, at least in the rachis, are transformed into solitary claws; rachis on the upper surface smooth all over, at first convex and more or less grooved on both sides, where are inserted the leaflets, and with an acute salient angle and flat side faces from about the middle upwards; the lower surface is armed with at first solitary, then 3-nate and higher up, especially on the cirrus, 5-nate and half-whorled, robust, black-tipped claws. *Leaflets* numerous, more or less inequidistant but never distinctly grouped, sometimes in long parts of the rachis almost equidistant and 3–4 cm. apart; oftener however they are more or less geminate; towards the upper end the vacant spaces are longer than elsewhere; the leaflets rather firmly papyraceous, green, slightly paler beneath than above, elongate-lanceolate or ensiform, broadest below the middle and thence somewhat tapering towards a not very acute base and gradually acuminate to a very finely subulate, long and filamentous tip; the upper surface is not distinctly 3-costulate having the mid-costa very sharp and bristly spinulous towards the apex, and one secondary nerve, on each side of it, slightly stronger than the others and usually bristly from the middle upwards or occasionally almost smooth; on the lower surface the mid-costa is rather closely bristly, and the side nerves are bare, or one on each side of the mid-costa is occasionally bristly; transverse veinlets numerous, approximate, sinuous, rather sharp on both surfaces; margins minutely and not very appressedly spinulous; the largest leaflets are 30–40 cm. long, 22–28 mm. broad; those of the upper part are gradually smaller, the ultimate ones are rudimentary. *Male spadix* suprade compound, forming a large ovate, cupressiform, rather diffuse panicle, 35–70 cm. long, (longer in cultivated specimens) borne on a long (50–80 cm.), strongly flattened, very acutely two-edged, unarmed, 10–13 mm. broad, peduncular part; primary spathes papyraceous, exsuccous, cinnamon-brown on both surfaces, but slightly darker internally, glabrous, and very finely striate; externally furfuraceous when young, then glabrous, all completely unarmed; outer spathe very elongate (31·5 cm. in one specimen) acutely two-keeled obliquely truncate at the upper end, and with two unequal acuminate points, corresponding to each of the two keels and separated by a deep concave sinus; inner spathes gradually protruding one beyond the other, the second and third rounded at the apex or with two unequal points, the others acuminate, shorter and broader, all deciduous during the anthesis; the flowering axis at first furfuraceous, soon glabrescent, and almost polished, rigid, slightly zig-zag sinuous, the internodes somewhat angular and with numerous small depressions produced by the adjoining parts, not swollen at the junctures; partial inflorescences 7–8 in number; those of the summit small and with few branchlets, the lower ones—which are the largest—are 15–25, and in cultivated specimens as much as 35 cm. long, with a distinct axillary callus and 7–10 spreading, bifarious, gradually diminishing, spreading branchlets on each side broadly pyramidate in outline; the lower branchelets (the largest) have 5–6 distichous, gradually but speedily diminishing, spreading spikelets on each side: secondary and tertiary spathes have a very short annular, sheathing part, and are produced into a small triangular acute or acuminate point; spikelets with a distinct axillary callus, the lower ones of each branchelet (the largest) 2–4 cm. long, with 8–10 flatly bifarious flowers on each side; their axes are slender, zig-zag sinuous, angular; spathels striately veined, very shortly asymmetrically subinfundibular, produced externally to a broadly triangular bluntish point; involucre almost horizontally posticously subtended by its own spathel, shallowly cupular, orbicular or more or less distinctly bidentate. *Male flowers* inserted at an angle of 45°, in contact with each other, oblong-ovoid, obsoletely trigonous, bluntish, 4–5 mm. long; the calyx tubular, cyathiform, finely striately veined, slightly 3-toothed; the corolla about twice as long as the calyx, smooth, divided down two-thirds of its length, into three lanceolate, externally smooth segments; internally each of the segments is furnished at its base with two small callosities, between which springs a filament which in its lower part is connate with the undivided part of the corolla, and in the free part is subulate and has an inflected apex; anthers linear-lanceolate, acuminate, the cells slightly separated at the base and here obtuse; internally in the short tubular part the corolla has the appearance of being lined with a nectariflous tissue; from the bottom of the corolla rises the rudimentary pistil, which is formed by three long, linear, subulate rods, united by their bases and reaching to and even surpassing the middle of the corolla. *Female spadix* has a long peduncular part. exactly like that of the male spadix; the flowering panicle is rather broadly ovate, 40–50 cm. long and has only 2–3 large partial inflorescences and one very small one at the apex; the axial parts are more or less permanently rusty-furfuraceous; the main axis is angular; the lowest partial inflorescences are 20–35 cm. long, have a plano-convex, 2–7 cm. long peduncular part and a very conspicuous axillary callus and 5–8 distichous spikelets on each side; secondary spathes as in the male spadix; spikelets when in flower erecto-patent, when in fruit spreading or horizontal and with a distinct axillary callus; they are of variable length: the lowest of each inflorescence are the largest and 8–14 cm. long, have 7–10 bifarious flowers on each side; the others are gradually smaller; the axes are zigzag sinuous, the joints straight or slightly curved; spathels bracteiform with a very short annular limb produced at one side into a horizontal, broadly triangular acute point; involucrophorum pedicelliform, 2–5 mm. long, obsoletely angular, callous at its axilla, at its upper end truncate and with a very short limb which is slightly produced or only apiculate at one side; involucre almost at a level with, and immersed in the involucrophorum, shallowly cupular or pateriform, entire, orbicular or slightly more produced on the side of the neuter flower, of which the areola is rather distinct, not very sharply bordered, often depressed and with a more or less swollen scar. *Female flowers* elongate, ovoid, 7 mm. in length; the calyx cyathi-form-campanulate, obsoletely 3-toothed, very soon split into three parts, callous at the base, rather sharply striately veined; corolla twice as long as the calyx, entire and slightly ventricose in its lower half; the segments lanceolate, not very acute; staminal urceolum slightly longer than the undivided part of the corolla, crowned with six triangular subulate teeth; anthers deeply sagittate; ovary ovoid, style very short, stigmata narrow, subulate, protruding beyond the apex of the segments during the anthesis. *Fruiting perianth* obconical, distinctly pedicelliform. *Fruit* ovoid-ellipsoid, suddenly and rather stoutly conically beaked, 18–23 mm. long, including the beak and the perianth, and 12–15 mm. broad; scales in 15 longitudinal series, 7–8 in each series (not reckoning the very small ones of the rostrum), narrowly grooved along the centre, of a dull dirty light yellowish or reddish-brown colour, slightly darker near the margins, and especially towards the point, which is not or only slightly produced and is obtuse; margins narrowly scarious, finely erosely toothed. *Seed* 16–17 mm. long, 11 mm. broad, 10 mm. thick, or at times considerably smaller; very slightly flattened, rounded at both ends, minutely pitted on the surface, when divested from a thin crustaceous, probably once fleshy, integumentum; the chalazal fovea indistinct; albumen rather deeply ruminated; embryo basal, about as long as one-fourth of the entire length of the seed.

HABITAT.—The Malayan Peninsula: at Malacca (*Griffith*, *Maingay* No. 1534 in Herb. Kew.); at Selandan (*Ridley*, No. 10794 in Herb. Calcutta); in the State of Johore at Muar and Tanjong Kupang (*Ridley*, No. 6286 in Herb. Beccari); Singapore at Changi (*Ridley*, No. 6276 in Herb. Beccari), at Chanchu Kang (*Ridley*, No. 3482 and 3496 in Herb. Beccari) and at Bukit Timah (*Ridley*, No. 9143 in Herb. Beccari); Billiton (*Riedel* in Herb. Beccari); West Sumatra (*Blume*); Butor Island (*Baker*, No. 688 —specimen in Herb. Bogor); Bangka, at Djebus and Sungei Liat (*Teijsmann* in Herb. Bogor. Griffith gives the Malayan name "Rotang Dodow" in Malacca; Ridley "Rotang Machap" in Singapore, and Teijsmann "Rotang Tanah" in Bangka.

OBSERVATIONS.—I have reduced *D. strictus* Bl. to *D. longipes* after careful examination of portions of Blume's authentic specimens, at least in regard to the female spadix, which in the smallest details and in the fruit in no way differs from the corresponding parts of the type specimens of Griffith's *Calamus longipes*.

D. longipes varies a good deal in the dimensions of the spadices and size of the fruits. One of Ridley's specimens from Singapore has a male spadix with the parts more robust but at the same time more contracted than usual, the flowering panicle being only 35 cm. in length with seven (including that of the apex) gradually diminishing partial inflorescences, while in a specimen cultivated at Buitenzorg the flowering panicle is about 1 m. in length, has 6–7 large partial inflorescences and some others smaller in its terminal part; the largest partial inflorescences are as much as 40 cm. long. The male spikelets of *D. longipes* look much like those of some *Graminaceæ* and their male flowers have, as in *D. verticillaris*, nectariform bodies between the stamens, and the inside of the tubular part of the corolla has the appearance of being lined with a nectariflous tissue.

D. longipes seems to vary also a good deal in the dimensions of the fruit. The largest seen by me are those of Ridley's specimen No. 6276, from Singapore, which are 23 mm. long (including the beak and the perianth) and 15 mm. broad, while in Riedel's specimen from Billiton the fruit is 18–20 mm. long (including the beak and perianth), and 12 mm. broad; the seed is 11–12·5 mm. long and 9–9·5 mm. broad and 8 mm. thick. The fruits from Sungei Liat in Bangka are also 8 mm. long and 12 mm. broad. The leaves vary in the degree of regularity of arrangement of the leaflets, sometimes these being almost equidistant throughout except at the upper end.

Some fruits preserved in the Leiden Herbarium and said to have been collected by Siebold in Japan (probably in the Liu Kiu islands) are undistinguishable from those of *D. longipes*, except that they are smaller, 19 mm. long (including beak and perianth) and 10 mm. broad.

D. longipes is easily distinguishable by its leaf sheaths armed with very broadly laminar spines, which are particularly long around the mouth of the leaf-sheaths; by the hispid ocrea; by the leaves with more or less inequidistant, but not grouped, leaflets; by the entirely unarmed thin primary spathes; by the elliptical fruit; by the obconical pedicelliform fruiting perianth; by the male spikelets with flatly bifarious ascendent flowers, and finally by the male flowers which have a nectariform tubercle between the bases of the filaments.

PLATE 92.—Daemonorops longipes *Mart.* Intermediate portion of a leaf (upper surface); lower portion of a female spadix in flower; an entire partial inflorescence with not quite mature fruits (in the lower part of the plate): from Ridley's No. 3496 in Herb. Beccari. The upper end of a spadix with quite mature fruits: from Ridley's No. 6276 in Herb. Beccari.

PLATE 93.—Daemonorops longipes *Mart.* The lower portion of a male spadix in flower with the lowest entire partial inflorescence: from a plant cultivated at Buitenzorg in Herb. Beccari. Male spadix; intermediate portion of a leaf (upper surface); lower portion of a petiole (back view): from Ridley's No. 6292 in Herb. Beccari.

82. DAEMONOROPS LONGISPATHUS Becc. in Rec. Bot. Surv. Ind. ii, 230.

DESCRIPTION.—A rather robust plant, apparently beginning to flower when a young and erect plant, but later scandent. *Sheathed stem* 3–4 cm. in diameter. *Leaf-sheaths* not gibbous above, more or less covered, like all the other parts of the plant, except the leaflets, with a rusty-brown adherent scurf, and densely armed with numerous unequal, but frequently large spines, which are as much as 5–6 cm. long and 2–4 mm. broad at their bases, flat, elastic, very acuminate, ascendent or spreading, solitary, or at times more or less transversely seriate, very light-coloured, but covered in the young shoots with small approximate patches of rusty scurf; near the mouth, on the ventral side, the spines are very crowded, and larger than in any other part, and as much as 10–18 cm. long. *Ocrea* very short, furfuraceous, devoid of hairs or bristles. *Leaves* very large, 2·75 m. long (in one specimen) in the pinniferous part, and terminating in a robust cirrus, 1 m. in length; other leaves, according to their position on the stem, are not or only rudimentarily cirriferous; petiole very robust, elongate (75 cm. long in one specimen), 15–18 mm. broad at its base, flattish, or slightly convex on the upper surface where prickly only near the margins, convex on the back, the margins not very acute, strongly armed at the base with long irregular, spreading spines, which become shorter, more robust, often geminate or digitate-ternate and divergent higher up; on the lower surface, along the centre of the dorsum, the spines of the petiole are at first solitary or digitate-ternate and deflexed, but straight, and then are transformed into claws on the rachis; on the upper surface the rachis is smooth throughout, at first is broadly grooved at the sides where the leaflets are inserted and has a salient angle in the centre, obtuse at first, then very acute, with flat side-faces; on the lower surface the claws are at first 3-nate and then 5–7-nate and half or three quarters whorled in the cirrus: they are exceptionally strong, and have a reversed but rather straight point. *Leaflets* numerous, equidistant, 3–4, and in very vigorous specimens 5–7 cm. apart; they are firmly papyraceous, almost glossy, and concolorous on both surfaces, elongate-lanceolate or ensiform, broadest about or a little below the middle and thence tapering towards the base and acuminate to a subulate and sometimes more or less caudiculate and bristly, spinulous tip; on the upper surface the mid-costa is slender, very sharp, smooth or very sparingly spinulous from the middle upwards and has several unequal smooth secondary nerves on each side of it, but none of these is considerably stronger than the others. On the under surface all nerves are slender and smooth; transverse veinlets numerous, sinuous and interrupted, rather sharp on both surfaces; margins acute, remotely, minutely, and appressedly spinulous; the largest and intermediate leaflets are 35–45 cm. long, and 3–4 cm. broad, the lowest are narrower, and the uppermost smaller and have longer filiform tips than the others. *Male spadix* large, elongate; one specimen has 15 or 16 partial inflorescences which form on the whole a large, cupressiform very acuminate panicle, 2·1 m. in length; the main axis is straight, very slender at the upper end; the internodes are 12–15 cm. long, angular, not swollen at the junctures; upper internodes strongly flattened; primary spathes deciduous, very thinly coriaceous, or thickly papyraceous, narrowly or elongate-lanceolate, reddish brown, glabrous, finely longitudinally striate and darker internally: externally covered with a very adherent, thin, irregular, more or less confluent, scaly, rusty-furfuraceous indumentum; the outermost spathe is 45 cm. long (in one specimen), and is 5 cm. broad, spreads out almost flat during the anthesis, very acutely two-keeled; the keels armed with small, short, ascendent spines; inner spathes unarmed, each gradually protruding beyond the other, very acuminate; partial inflorescences varying a good deal in size; the lowest form a rather dense, ovate, acute, spreading panicle up to 40 cm. long and 20–25 cm. broad, with 4–5 distichous branchlets on each side, besides several simple spikelets in the terminal part; the following inflorescences are gradually smaller, and the uppermost consist of a few simple spikelets; the branchlets follow the same rule, the lowest being the largest, and the following becoming gradually smaller, and with fewer spikelets; the lowermost branchlet of each inflorescence is 15–20 cm. long, and has 6–8 spikelets on each side; the axis of the branchlets is straight, rather slender and angular; secondary and tertiary spathes very thinly membranous, exsuccous, reddish-brown, as are every appendicular part and the flowers themselves; these spathes are infundibuliform and embrace the bases of the branchlets and of the spikelets, and are conspicuously produced on one side into a spreading, plicate, broadly triangular, acute point; they are usually longitudinally cleft on one or other side; spikelets spreading, callous at their insertion, slightly flexuose, explanate, the flowers being perfectly flatly bifarious; the lowest spikelets are 6–7 cm. long, and have 18–20 contiguous flowers on each side; spathels approximate, shortly and widely infundibular, horizontally truncate, glabrous, finely reticulate and striately veined, their points obtuse and subtending their respective flowers, frequently more or less lacerated; involucre entirely immersed within its spathes, very obliquely cupular, being produced on the posticous side, where acutely 2-keeled, the keels furfuraceous or covered with small paleolae. *Male flowers* linear-oblong, obtuse, slightly curved, inserted at an angle of about 45°, 5 mm. long, 1·5 mm. thick; the calyx tubular-cyathiform, with 3 short and broad teeth which have a tuft of ferrugineous paleolae on their apex; the corolla about twice as long as the calyx, parted not quite down to the base into three linear segments so as to have only a very short tubular part; the stamens have the base of the filaments connate to the undivided or tubular part of the corolla, are subulate in the free portion, and have inflected apices; anthers versatile, linear, very narrow; rudimentary ovary formed by three small linear, subulate bodies, about as long as the tubular part of the corolla. *Female spadix* not very different from the male, but of very variable dimensions; the panicle varies from 40 cm. to 1·2 m. in length, and is borne on a peduncular part about as long; this part is strongly flattened, 7–15 mm. broad according to the size of the panicle, straight, slightly convex on one side, and flattish on the other, sharply two-edged, usually smooth on both surfaces, or exceptionally slightly prickly; its edges are armed with short, straight, solitary or sub-digitate spines; primary and secondary spathes as in the male spadix, deciduous; the main axis rigid, obsoletely angular; the internodes not swollen at the junctures, smooth surfaced; partial inflorescences callous at the axilla, 6–10 in number, besides 2–3 in the terminal part, where they are reduced to single spikelets; the lowest partial inflorescences average from 25 to 30 cm. in length, and have 6–7 spikelets on each side, but occasionally are much smaller, and have fewer spikelets; the largest spikelets are 10–12 cm. long, and have 12–15 distichous flowers on each side; spathels thinly membranous, exsuccous, very finely striately nerved, at first furfuraceous, later glabrous, infundibular, produced externally into a triangular acute point that subtends the flowers; involucrophorum immersed in its own spathel, spathaceous–auriculiform, acutely 2-keeled on the posticous side; involucre immersed within the involucrophorum, deeply asymmetrically cupular, being considerably more evolute on the side of the neuter flower than on the other; the areola of the neuter flower ovate, sharply defined by raised margins, which, like the keels of the involucrophorum, are fringed with ferrugineous, later deciduous, paleolae. *Female flowers* oblong 5·5–6 mm. long; the calyx shortly campanulate, slightly 3-toothed; the teeth have a brush of ferruginous paleolae at their apex and are very soon split into 3 parts; the corolla is two and-a-half or nearly three times as long as the calyx, deeply parted into 3 lanceolate subacute segments; calyx and corolla very finely striately veined externally; stigmas linear, during the anthesis spreading, or slightly recurved, peeping out between the segments. *Neuter flowers* very similar in size and shape to the males. *Fruiting perianth* entirely explanate. *Fruit* rather small, ovoid-elliptical, rounded at both ends, distinctly beaked, 15–16 mm. long, 12 mm. broad; scales in 15 longitudinal series, glossy, strongly convex, deeply grooved along the centre, of a uniform cinnamon-brown colour and with a very narrow, scarious finely erosely-toothed edge. *Seed* ovoid, rounded at both ends, sinuously grooved on the surface; chalazal fovea indistinct; albumen ruminate; embryo basal.

The different parts of the spadices, the spathels, involucra and flowers are of a uniform reddish cinnamon-brown colour.

HABITAT.—Borneo: in Sarawak at Sibo near the sea-shore, not far from the mouth of the homonymous river (*Beccari* P. B. No. 2193), and in similar situations at the mouth of the Bintulu (*Beccari* P. B. No. 3697). Low has appended the vernacular name of "Rotang bibuloh" to a specimen of this plant preserved in the Kew Herbarium and certainly collected in Borneo, but the exact locality is not stated. From British North Borneo a fruiting specimen has been sent to Kew by Governor *Creagh*. It is cultivated in the Botanical Garden at Buitenzorg, forwarded by *Oxley*.

OBSERVATIONS.—*D. longispathus* in many respects approaches the species of *Calamus* of the *C. platyspathus* group, especially as regards the structure of the primary spathes; its male and female spikelets are also exactly similar to those of a *Calamus*, as they have well conformed infundibular spathes, and approximate flatly-bifarious flowers. The structure of the female flowers, however, is that of a typical *Daemonorops*, and its relations to other species of this genus are not doubtful. It is a very variable plant in regard to the dimensions of the spadices. I have derived the description of the male plant from specimens cultivated at Buitenzorg. *D. longispathus* is somewhat related to *D. longipes*, and even more to *D. ruptilis*, though perfectly distinct from these as from any other species known at present.

PLATE 94.—Daemonorops longispathus *Becc.* Upper portion of a male spadix; portion of a leaf from near its upper end (under surface): from a plant cultivated at Buitenzorg (Herb. Becc.).

PLATE 95.—Daemonorops longispathus *Becc.* Intermediate portion of a leaf (under surface); lower portion of a petiole; an entire female spadix in flower: from P. B. No. 2193 in Herb. Beccari. Spikelet with mature fruits; from Creagh's specimen in Herb. Kew.

83. DAEMONOROPS ACAMPTOSTACHYS Becc. sp. n.

DESCRIPTION—*Stem* . . . . . . *Leaf-sheaths* . . . . . *Leaves* apparently large; in the small portion seen by me the rachis is bifaced, and has an acute smooth salient angle on the upper surface; it is armed beneath at intervals of 5–6 cm. with digitate (3–5-nate), confluent, straight, light-coloured, rather slender, 5–8 mm. long, deflexed spines and also with a few, very small, scattered claws. Leaflets numerous, subequidistant, 3–5 cm. apart, sometimes obscurely paired on each side, elongate-lanceolate, those of one side conspicuously shorter and also slightly broader than those of the other side, those of the right-hand side being 31–32 cm. long, 25–30 mm. broad, and the others 40–42 cm. long and 22–28 mm. broad; they are firmly papyraceous, more or less plicate, almost glossy and concolorous on both surfaces, broadest about or a little below their middle and thence tapering towards the base and upwards acuminate to a subulate and caudiculate tip that is bristly at the sides; on the upper surface they are subtricostulate with the mid-costa prominent, sharp, and very sparingly spinulous only near the apex; the side costae very slender and smooth; secondary nerves few, inconspicuous; the under surface quite smooth; transverse veinlets innumerable, very minute, subpunctiform and immersed in the parenchyma; margins very minutely, appressedly and remotely spinulous. *Male spadix* . . . . *Female spadix* very rigid, forming a dense, strict, narrowly cupressiform panicle: that seen by me, which I do not know if it be entire, is 40 cm. long, has 6 erect very appressed, gradually diminishing partial inflorescences; primary spathes deciduous; the main axis very rigid, subterete or slightly flattened, fugaciously furfuraceous; the internodes not swollen at the junctures and not marked by depressions caused by the adjoining parts; partial inflorescences not callous at their insertion, ovate in outline, the lower 10–13 cm. long with 6–7 very regularly pinnately set spikes on each side that are inserted at an angle of 45° and speedily decrease in length and number of flowers from the base towards the summit; secondary spathes have a shortly infundibular or subannular limb, which is obliquely truncate at the mouth, and produced at one side into a triangular, dry, thinly membranous, acute or acuminate point and is often more or less split; the spikelets are rigid, rather thick, with biseriate, slightly assurgent flowers; the lower spikelets are 5–6 cm. long and have 6–7 approximate flowers on each side; the others are gradually shorter, while those of the upper extremity are only 1–2 cm. long and have 4–6 flowers in all; the axes of the spikelets are strongly and closely zig-zag sinuous; spathels fugaciously furfuraceous, shortly, broadly and unilaterally infundibuliform, produced at one side into a dry, membranous, triangular, acute, usually split point, that subtends its own flower; involucrophorum shortly and broadly infundibuliform, truncate, obsoletely keeled on the posticous side, exserted from its own spathel; involucre immersed in the involucrophorum, unilaterally cupular, lunately emarginate on the side of the neuter flower, of which the areola is conspicuous, broadly ovoid or sublunate and very sharply bordered. *Female flowers* ovoid, 7 mm. long; the calyx shortly campanulate or cyathiform, slightly 3-toothed, very soon split into 3 parts; the corolla not quite twice as long as the calyx, deeply divided into 3 ovate, acute, very soon longitudinally lacerated segments. The very young fruit is globose-ovoid and narrows into a conical thick style, which is crowned by the acute recurved stigmas.

HABITAT.—Borneo: Mount Mattang near Kuching, collected in Sept. 1905 by *H. N. Ridley*, (No. 12395 in Herb. Kew.).

OBSERVATIONS.—This species is characterized by the subequidistant, relatively large and broad, elongate, lanceolate leaflets, but especially by the very rigid, strict, cupressiform female spadix which has the secondary spathes and the spathels almost regularly infundibuliform, similar to those of a *Calamus*, and from this apparently related to *D. longispathus*.

Of *D. acamptostachys* I have seen only an intermediate portion of a leaf and a spadix with very young fruits.

Plate 96.—Daemonorops acamptostachys *Becc.* Portion of a leaf near its upper end; spadix with growing ovaries: from Ridley's No. 12395 in the Herbarium at Kew.

84. Daemonorops ruptilis Becc. in Rec. Bot. Surv. Ind. ii, 230.

Calamus ruptilis H. Wendl. (name only in Herb. Kew.).

Description.—Scandent; apparently large. *Leaf-sheaths* armed at the mouth with numerous, very large (as much as 20–25 cm. long and 3–5 mm. broad), erect, laminar spines, and all over the body with numerous similar spines but shorter. *Leaves* very large, terminating in a rather robust cirrus; petiole armed at its base with large light-coloured, laminar, unequal (1–5 cm. long) spines, which point in different directions; rachis smooth on the upper surface; underneath it is at first smooth or armed sparingly with solitary claws, which become ternate higher up and rather closely and regularly half-whorled towards the end, especially on the cirrus. *Leaflets* numerous, equidistant, rather distant (–7 cm. apart), papyraceous, rather glossy, green and concolorous on both surfaces, ensiform or very narrowly lanceolate, broadest about their middle and thence tapering towards an acute base, and very gradually acuminate to a finely subulate slightly asymmetrical and bristly tip; on the upper surface the mid-costa is acute and bare and the secondary nerves are slender and also bare; on the lower surface the mid-costa alone has a few long bristles, or is entirely bald; transverse veinlets very numerous but indistinct; the margins smooth, except near the apex, where they are furnished with a few spinules, longer and more numerous on the small sub-apical indentation of the lower margin than elsewhere; the largest leaflets are apparently those near the base, and are 60 cm. long and 3 cm. broad; other leaflets, probably of the intermediate portion, are 35–40 cm. long and 2–3 cm. broad; some of the upper end measure only 23 cm. in length and 3 cm. in width. *Female spadix* large; one, which apparently wants only its peduncular part, is 75 cm. long, and carries 4 partial inflorescences; all the axial parts are of a cinnamon-brown colour when dry, and are more or less fugaciously covered with a thin rusty-brown, furfuraceous indumentum; the main axis is thickish, 18 mm. in diameter at its base, and terminates in a tail-like unarmed appendix, which is about 20 cm. long and is sheathed by several incomplete spathes; the internodes are straight, subterete or obsoletely angular, slightly swollen at the nodes; primary spathes thickly coriaceous, the outermost not seen by me; the others elongate; one of these, apparently the second, is 44 cm. long and 4 cm. broad, very narrowly lanceolate, very acuminate, spread out flat, quite unarmed, carinate especially near the apex, coarsely striate, or ridged with about 10 strong costae on the back; the inner surface is also striate but the ridges are finer and closer; partial inflorescences robust, spreading; the lowest, which is also the largest, is 40 cm. long and has 10 large spikelets; of these, one is apical and the others are alternately distichous; the succeeding inflorescences are shorter and have fewer spikelets; the last consists of a single spikelet 34 cm. in length; secondary and tertiary spathes membranous, exsuccous, cinnamon-brown in colour, shortly infundibular-amplectent, laterally produced into a broadly triangular acuminate, lacerate limb; the axes of the partial inflorescences have the internodes short, thick, subterete or obsoletely angular and swollen at the nodes; spikelets spreading, very conspicuously callous and with a transverse rima at their axilla; they have a very short (1 cm. long) pedicellar part, are 15–18 cm. long, are thick and robust and have many closely packed flowers; the terminal spikelet (which is 20 cm. long) has the flowers almost regularly bifariously set; the others have usually the flowers disposed in 4 series in their basal part, and bifariously towards the apex; spathels large, spathaceous, exsuccous, more or less split longitudinally and embracing their flowers which they exceed considerably in length; the involucrophorum has a very short rusty-furfuraceous pedicellar part and suddenly expands into a broad asymmetrically spathaceous and at times, split, obtuse limb; involucre rather deeply and asymmetrically cupular, partially immersed in the involucrophorum; the areola of the neuter flower is not sharply defined, but has a rather large non-callous scar, which is hidden within a kind of small cupula, formed by the shorter side of the limb of the involucrophorum. ***Female flowers*** comparatively large, 8 mm. long; the calyx it cyathiform-campanulate, truncate, has 3 inconspicuous teeth, and later is irregularly split: callous at its base; the corolla twice as long as the calyx, its segments ovate-lanceolate, gradually narrowing towards a rather obtuse point, very faintly striate longitudinally. ***Fruit***, in the very young stage, ovoid-oblong, tapering to a short and thick style, and crowned with 3 large, thickly trigonous-subulate, internally lamellose, recurved stigmas; scales in 15 longitudinal series, slightly grooved along the centre, yellowish or greenish, and with a very obtuse or rounded point.

HABITAT.—Borneo; but the exact locality unknown; collected only by *Low* with very immature fruit (Herb. Kew. and Calcutt.). Malay name "Rotang biluboh ambuk."

OBSERVATIONS.—*D. ruptilis* is a very distinct species, related only to *D. longispathus*; it is easily distinguishable by its robust spadix, with very large and thick spikelets; by the large, spathaceous, lacerate secondary spathes and spathels, which are longer than their respective flowers; and by the 4-farious flowers, at least in the lower part of the spikelets.

A specimen preserved at Kew collected also by Low in Borneo and distinguished by the Malay name of "R. tambyeangan" apparently belongs to *D. ruptilis*. This specimen is represented by a male spadix with very young flowers, and by a portion of a leaf, which in no way differs from the corresponding part that accompanies the female spadix described above. Of this male spadix I subjoin a description as I consider it as almost certainly belonging to *D. ruptilis*:—It is 70 cm. long on the whole, straight and rigid; the peduncular part is very short, 12 mm. broad, flattened, with the edges acute and armed with ascendent subulate spines; the partial inflorescences are 4 in number, beside a few others very small at the summit; primary spathes coriaceous, elongate, all unarmed, the outermost with 2 dorsal keels and gradually narrowing into a long point; secondary spathes loosely infundibular, membranous, not so large as in the female spadix; partial inflorescences slightly branched; the lowest and at the same time the largest, has 7 spikelets in all; the spikelets are about 6 cm. long, and have very approximate, perfectly bifarious flowers, and do not differ from the spikelets of a typical *Calamus* of the group of *C. palustris*; they have approximate and subcymbiform spathels, a regularly cupular involucre, and have the flowers subtended by the point of their respective spathels. The flowers are too young to be described precisely but apparently they are obtuse, have a campanulate or cyathiform finely striately veined calyx and a corolla with smooth and externally glossy segments. The leaflets are 35–40 cm. in length and 2–3 cm. in width.

PLATE 97.—Daemonorops ruptilis *Becc.* Intermediate portion of a leaf (under surface); portion of the spadix with young fruits; one of the young fruits enlarged 4 dmeters: from the type specimen in the Herbarium at Kew.

ADDENDA.

ADDENDA.

I had just completed the monograph of all the species of *Daemonorops* known up to a few months ago when new and important materials, which had been put into my hands by the late Dr. M. Treub and by Colonel D. Prain, rendered the present supplement necessary. Except *D. bakauensis*, all the new additions are from Borneo, collected by the late Mr. Teijsmann and by Dr. H. Hallier, and preserved in the "Herbarium Horti Botanici Bogoriensis," or by Mr. J. Hewitt in Sarawak, and sent to the Herbarium at Kew.

This supplement brings the species of known *Daemonorops* up from 84 to 91 and thus alters the statistical data which I drew up in the chapter on the geographical distribution of the species of that genus, though only in respect of the Flora of Borneo.

The number of species of *Daemonorops* known to exist in Borneo at the present day is raised from 26 to 33, of which 4 belong to the division *Cymbospatha:* of these 3 are endemic. On the whole, the endemic *Daemonorops* in Borneo amount to 28, several of these being quite peculiar forms, which exhibit but little affinity with species from other countries. Of this number are *D. ursinus*, *D. formicarius*, *D. sparsiflorus*, *D. asteracanthus*, *D. scapigerus*, *D. cristatus*, *D. acamptostachys*, *D. ruptilis*, *D. floridus*, *D. spectabilis*.

D. turbinatus is a fine addition to the list of species belonging to the group which is furnished with ant-harbouring galleries.

D. bakauensis is a species without prominent characteristics, growing in a small island near Linga, and is the only known endemic species of *Daemonorops* discovered in the group of the minor Sunda Islands. These, apparently, do not possess a very individualised flora, but contain vegetable forms identical with, or very closely related to, species growing in Borneo, in Sumatra, or in the Malayan peninsula. These islands, however, have not as yet been sufficiently explored on the botanical side.

14*bis*. (85) DAEMONOROPS PACHYROSTRIS Becc. sp. n.

DESCRIPTION.—Scandent and of moderate size. *Sheathed stem* apparently 3–3·5 cm. in diameter. *Leaf-sheaths* armed rather densely with almost uniformly scattered or at times subseriate, unequal, straight, horizontal, dark brown or blackish spines, of which some are very small and only 3–5 mm. long, others are 15–18 mm. long and 3–5 mm. broad at their bases. *Leaves* apparently rather large; the petiole is rather robust, about 2 cm. broad, very slightly concave on the upper surface where minutely prickly but only near the margins, rather densely armed on the back with unequal, straight or hooked spines; the rachis in the intermediate and upper portion is bifaced on the upper surface and smooth on the salient angle; the cirrus, like the upper part of the rachis, is powerfully armed with half-whorled claws. Leaflets very numerous, equidistant, usually 20–22 mm. apart on each side, narrow, linear, very acuminate; the medials 35–38 cm. long, 12–14 mm. broad, distinctly 3-costulate on the upper surface with short, rigid bristles on the 3 costae, but especially on the side ones and at times another secondary nerve also bristly; on the lower surface the mid-costa alone bears rather long bristles; the margins are very minutely spinulous-serrulate; transverse veinlets very short and irregular. *Male spadix* . . . . *Female spadix* erect, attached about midway of the exposed part of the leaf-sheath, or at least not very near its mouth, and borne on a short (2–3 cm. long), rather thick, densely prickly, pedicellar part; primary spathes . . . . ; the fruiting panicle is broadly ovoid, about 20 cm. in length, very dense and composed of 4–5 very approximate partial inflorescences; the first or basal internode is also short, 1·5–2 cm. long, thick and rigid; the partial inflorescences have several very approximate spikelets; secondary and tertiary spathes annular and produced at one side into a short concave, bracteiform, triangular, acute limb; spikelets 3–6 cm. long, the largest have 4–5 flowers on each side; their axes are rather slender and sinuous; spathels similar to the tertiary spathes; the involucrophorum is callous at its axilla and has a pedicellar part which is 2–3 mm. long, angular, narrow's towards the base, and is expanded at its upper end into a bracteiform, concave, asymmetric, and at one side acute limb; involucre rather deeply cupular, often asymmetrically evolute, apiculate at one side, otherwise entire; areola of the neuter flower depressed, distinctly marked above by a swollen crescent-shaped callus. *Fruiting perianth* almost explanate; the fruit however is rendered distinctly pedicellate by the involucre. *Fruit* (quite mature) elliptical-ovoid, abruptly terminated by a stout beak, 15-16 mm. long (including the beak) and 11 mm. broad; the beak alone is 4 mm. long and 3 mm. broad; scales arranged in 15 longitudinal series, almost glossy, very slightly convex and very superficially or indistinctly grooved along the centre, of a reddish brown colour and with a narrow, light-coloured scarious, erosely toothed margin, the apex slightly produced, dark and bluntish. *Seed* globose-ovoid or slightly longer than broad, 9·5 mm. long, 8·5 mm. broad, 8 mm. thick, almost equally convex on both sides (not ventricose on the raphal side).

HABITAT.—N.-W. Dutch Borneo: at Smittouw in the Residency of Sambas (*H. Hallier* No. 1310 in Herb. Hort. Bot. Bogor.).

OBSERVATIONS.—It is related to *D. angustifolius*, *D. trichrous* and *D. fissus*, but it is distinguishable by its small ovoid fruit, abruptly surmounted by a stout beak, more conspicuous by far than that of any other fruit of the allied species; also good diagnostic characteristics of *D. pachyrostris* are the fruit scales, very slightly convex, and only obsoletely grooved along the centre, and the regularly globose-ovoid seed, not more ventricose on the raphal than on the opposite side.

PLATE 98.—Daemonorops pachyrostris *Becc.* Hallier's type specimen No. 1310 in Herb. Hort. Bot. Bog.

20*bis*. (86) DAEMONOROPS HALLIERIANUS Becc. sp. n.

DESCRIPTION.—Apparently scandent and rather slender. *Sheathed stem* about 2 cm. in diameter. *Leaf-sheaths* more or less distinctly pluri-costulate longitudinally, covered when young with a dark tobacco-coloured, partly fugacious indumentum, and rather powerfully armed with obliquely and irregularly seriate, long, thinly-laminar, almost confluent, blackish or schistaceous, elastic, 15–28 mm. long spines; petiole rather elongate, 20–30 cm. long, flattish and smooth on the upper surface, convex and more or less prickly or even almost smooth along the centre on the back; the margins acute and armed with straight spines, especially near its base, where they are longer than higher up, at times as much as 5–6 cm. in length; the rachis has on the back a line of claws along the centre, solitary at first, ternate towards the upper end, quinate on the cirrus; the salient angle on the upper surface is very sharp and smooth; leaflets very numerous and approximate, 12–15 mm. apart, very regularly equidistant, narrowly or linear-ensiform, very finely acuminate, sub-3-costulate; on the upper surface the side costulae have short bristles throughout from not very far above their bases, but the mid-costa is bristly only near the apex; on the lower surface the mid-costa alone is very minutely, and very closely ciliate; at times on the upper surface another secondary nerve is more or less bristly; margins closely bristly-spinulous; the intermediate leaflets, which are the largest, are 25–30, or at times 30–35 cm. long, 12–13 or also 16–17 mm. broad. *Spadices* before the anthesis rather narrowly fusiform, erect, inserted not far below the mouths of their respective sheaths, almost sessile, but with their short pedicellar part decurrent along the sheaths, and densely prickly; the outermost spathe is cymbiform, very densely armed with long (up to 4 cm.), slender, feeble and flexible, reversed, subseriate spines, and is prolonged to a beak about as long as the body, at times furnished on its upper part with a few, but very long, rigid, hair-like spiculae; the second spathe is armed with ascendent spiculae, especially along two very obsolete carinae. *Female flowers* ovoid, 8 mm. long. The *fruiting panicle* is small, erect, 10–12 cm. long, dense, formed by 4–5 very small, very approximate branches or partial inflorescences, each of these composed of 3-5 spikelets; the spikelets are very small, 15–25 mm. long and carry 3–5 flowers in all; involucrophorum callous at its axilla, more or less pedicelliform (1–3 mm. long), expanded at its upper end into a bracteiform, concave, asymmetrical and at one side acute limb; involucre shallowly cupuliform, often slightly asymmetrical and more or less split on the margin; areola of the neuter flower depressed, more or less callous round the scar. *Fruiting perianth* explanate; the calyx, split in 3 parts, obscurely striate-costulate or almost smooth. *Fruit* spherical, 16–17 mm. in diameter, terminating in a short, conical, very acute beak; scales rhomboidal, slightly broader than long, arranged in 15 longitudinal series, not deeply and rather broadly grooved along the centre; they are dull, of an uniform reddish or cinnamon-brown colour, and have an almost polished, narrow, smooth (not crisped), darker band all round; the extreme margin is very obsoletely erose; the point is obtuse. *Seed* subglobular-reniform, broader than long, slightly flattened, slightly ventricose on the raphal side, very minutely granulate, 12–12·5 mm. long, 14·5 mm. broad, 10 mm. thick.

HABITAT.—N.-W. Borneo. The type specimens I consider those of the Buitenzorg Herbarium collected by *Hallier* (Nos. 374 and 375) at Pulan Lemukutan, a small island near the north-west coast of Borneo in the Residency of Sambas. It has been found, also by *Hallier*, at Liang-gagan in this same Residency and also at Sungei

Kenepai (respectively Nos. 2910 and 2129 Herb. Hor. Bot. Bogor.) Not differing from Hallier's Nos. 2910 and 2129 are other specimens collected by *Hewitt* at Quop in Sarawak (Herb. Kew.).

OBSERVATIONS.—*D. Hallierianus* is apparently related to *D. Sepal* and especially to *D. pseudo-sepal*, and like it, has the leaf-sheaths costulate longitudinally and is very similarly armed with relatively large laminar spines. Probably Hallier's Nos. 2910 and 2129 belong to the *Daemonorops* mentioned by Ridley (Materials for a Flora of the Malayan Peninsula ii, 176) as a native of Borneo, under *D. monticolus*. I have described the fruit of the plant from Pulau Lemukatan, which must be considered as representing the type of the species. The Lemukatan plant differs from those of Sarawak and Liang-gagan in the leaf-sheaths armed with lighter (schistaceous) spines and in the leaflets larger (30–35 cm. long, 16-17 mm. broad) than in the specimens of the other above-mentioned localities.

The fruit of *D. Hallierianus* (from Lemukatan) is very similar to that of *D. fissus* VAR. *cinnamoneus*, but in this the fruit-scales are very minutely crisped on the margins, while they are smooth in *D. Hallierianus*.

PLATE 99.—Daemonorops Hallierianus *Becc.* Intermediate portion of a leaf, and portion of the sheathed stem with a fruiting spadix (on the left side of the plate; portion of the spadix with a fruit; one seed: from Hallier's No. 374. Small, not yet open, female spadix and a branchelet with female flowers (in the centre of the plate): from Hallier's No. 2910. Portion of a stem with a male spadix and the upper end of a leaf, upper surface: from Hewitt's specimen in Herb. Kew.

21*bis* (87). DAEMONOROPS BAKAUENSIS Becc. sp. n.

DESCRIPTION.—Apparently scandent, rather slender. *Sheathed stem* 15 mm. in diam. *Leaf-sheaths* covered with a tobacco-coloured, furfuraceous, partially deciduous indumentum, more or less distinctly pluri-costulate longitudinally, armed, not very densely, with scattered or subseriate, spreading, thinly laminar, elastic, unequal, 1-2 cm. long, light-brown spines. *Leaves* of upper part of the plant apparently about 1 m. long in the pinniferous part; the petiole about 30 cm. long, 1 cm. broad, flat and smooth on the upper and convex on the under surface of its lower portion and more or less biconvex upwards, its margins rather sharp, and more or less irregularly armed with spreading straight spines; the rachis in its first and intermediate portion is armed along the centre of the lower surface with a single series of small claws, and has a smooth salient angle on the opposite surface. Leaflets moderately numerous, equidistant or nearly so, 4-5 cm. apart, ensiform, or very narrowly lanceolate, broadest about their middle, thence tapering to a rather acute base, and gradually acuminate towards a filamentose, sparingly bristly-spinulous tip; their mid-costa is acute, and has only a few spinules near the apex; of the side nerves one on each side of the mid-costa is sparingly bristly-spinulous and slightly thicker than the others, but the blade cannot be called 3-costulate; on the lower surface, the mid-costa alone is closely and very minutely ciliate; the margins are very appressedly and rather closely spinulous; the intermediate leaflets are 35–40 cm. long, 2–2·5 cm. broad at about their middle. *Male spadix* .... *Female spadix* inserted laterally near the mouth of the leaf-sheaths; the fruiting panicle is small, short, 11–12 cm. long, erect, has a very short pedicellar part (10–20 mm. long), smooth, or slightly prickly on the margins; the panicle is rather dense, formed by 3–4 very small branches or partial inflorescences, each of these composed of 3–5 spikelets; primary spathes . .. spikelets very small. 15–20 mm. long, with 3–5 flowers in all; involucrophorum callous at its axilla, very briefly pedicellate, expanded into a bracteiform, concave, asymmetrical and at one side acute limb; involucre symmetrical, very shallowly cupuliform, entire; areola of the neuter flower rather depressed with a very distinct callous rim above. *Fruiting perianth* almost explanate. *Fruit* small, globose-ovoid slightly and conically diminishing at upper end and very shortly beaked, 17 mm. in length including the perianth, 12 mm. broad; scales arranged in 15 longitudinal series, rather polished, slightly and broadly grooved along the centre, yellowish-brown with a narrow lighter scarious margin, and a black obtuse point. *Seed* somewhat flattened, suborbicular, almost equally convex on both surfaces, not ventricose on the raphal side, about 10 mm. broad, 7 mm. thick.

HABITAT.—In the small Island of Bakau to the north of the Island of Linga at 0°. 21 N. Lat., probably collected by *Teijsmann* (Herb. Hort. Bot. Bogor.).

OBSERVATIONS.—It is apparently related to *D. pseudo-sepal*, with which it agrees in its general aspect, in the equally armed costulate leaf-sheaths, and in the small, slightly-branched spadices; but it differs in the broader leaflets, and especially in the smaller ovoid fruit. It is also nearly allied to *D. Hallierianus*, but this has very regularly-set, approximate leaflets, and a rather large round fruit; while *D. bakauensis* has sub-inequidistant and rather remotely-set leaflets, smaller fruit and seed, and these of a different shape.

D. bakauensis is however one of those forms of the *Cymbospatha* group, destitute of prominent characteristics, which approach to more than one species, but do not exactly agree with any one of them, therefore, though reluctantly, we are obliged to distinguish it with a distinct name.

PLATE 100.—Daemonorops bakauensis *Becc.* The entire type specimen in Herb. Hort. Bot. Bogor.

47. DAEMONOROPS SPARSIFLORUS VAR. SARAWAKENSIS Becc. n. var.

DESCRIPTION.—Sheathed stem 2–2·5 cm. in diam. *Leaf-sheaths*, apparently when young, conspicuously mottled with white and green (the light-coloured patches resulting from a thin coating of white scurf), almost horizontally truncate at the mouth, where they are briefly edged by a rudimentary, membranous, dry, brittle, deciduous ocrea, and are almost without spines; the leaf-sheaths are also conspicuously pluri-costulate longitudinally, smooth on the costae, otherwise armed with scattered, broadly laminar, elongate-triangular, brown, very acuminate, very thin and elastic, spines, usually 1–3 cm. long, but at times much less. *Leaves* 0·9–1·1 m. long in the pinniferous part, prolonged into a long, very closely and very minutely clawed cirrus; the petiole is flattened, biconvex, 15–18 cm. long, 8–10 mm. broad, sparingly prickly on the obtuse edges, otherwise smooth above, and has only a few distant claws underneath along the centre; the rachis has a line of claws along the centre, solitary at first, ternate towards the end; above, the rachis is bifaced and has the salient angle acute, and is very narrowly grooved along the edge, the groove resulting from the mid-costa of the leaflets of one side, which are decurrent along and near the edge of the salient angle, and do not unite with the mid-costae of the leaflets of the other side; leaflets very numerous, 48 on each side of the rachis (Hewitt), very regularly and very closely set at a rather wide angle, otherwise exactly as in the forma typica. *Male spadix* elongate; before flowering it is about 60 cm. long, straight, rigid, flattened in its lower part, terete above beyond the first spathe, and acuminate at its upper end; primary spathes hard and thick, almost woody, conspicuously costulate, and deeply striate-sulcate longitudinally; the lowest spathe is somewhat flattened and has rather acute edges, those following before the anthesis are terete, and gradually protrude one above the other; all are unarmed, but furnished, at their upper end, with many, long, feeble, pale, bristles; the panicle is narrowly cupressiform, strict, acuminate, borne on an unarmed flattened pedicellar part 6–7 cm. long, and composed of 6–7 gradually diminishing, twice branched, appressed, dense, fastigiate or thyrsoid, partial inflorescences, of which the lowest is the largest and 13–15 cm. long; the lower branchelets are 6–7 cm. long and carry alternately and distichally 6–7 spikelets on each side; the axis of the branchlets is rigid, thickish at the base, about 2 mm. broad, is more or less sinuous, and speedily diminishes towards a finely subulate apex; the spikelets are inserted at a rather acute angle, have a very slender, filiform, rigid, slightly sinuous, angular axis; the largest spikelets are those at the base of the branchlets, and these are about 3 cm. long and bear 6–7 flowers on each side, which flowers rest on a small tubercle and are distichally set; the following spikelets are gradually but speedily shorter; the uppermost spikelets are only 10–15 mm. long, and have very few flowers; spathels and involucre obsolete. *Male flowers* oblong, blunt, 4 mm. long, 1·5 mm. broad, subtrigonous, or more or less flattened; the calyx is cyathiform from a flat base, truncate and very obsoletely 3-denticulate at the mouth, finely striately-veined; the corolla is at least 3–4 times as long as the calyx. *Female spadix* about 60 cm. long (in one specimen), nodding when in fruit, rather densely panicled, composed of 5–6 partial inflorescences, of which the lowest is 22 cm. long, is slightly branched in its basal part, and carries simple spikelets in the remaining portion; the other partial inflorescences have only simple spikelets, usually 8–10 on each side of the axis; the largest spikelets are 8–10 cm. long, have a rigid, subtetragonous, slightly zig-zag sinuous axis, carry 12–14 flowers on each side, and the flowers are almost regularly distichous; involucrophorum (pedicelliform) and involucre exactly as in the type. *Fruiting perianth* very shortly pedicelliform, from the hardened base of the calyx. *Fruit* spherical, minutely and acutely beaked, 12 mm. in diam., scales arranged in 15 longitudinal series, neatly and narrowly grooved along the centre, umber-brown with a rather broad, black margin all round, and a blunt apex. *Seed* somewhat flattened, orbicular, almost lenticular and almost equally convex on both sides, minutely tubercled, 1 cm. broad, 8 mm. thick; chalazal fovea obsolete; albumen bony, irregularly ruminate; embryo basal.

HABITAT.—Specimens with mature fruit and with male flowers, of this very peculiar variety of *D. sparsiflorus* were collected on the Baram River in N.-W. Borneo (Sarawak) by *Charles Hose* (No. 703 Herb. Brit. Mus.) and by *J. H. Hewitt* (Herb. Kew.). Another specimen with male spadices only quite similar to the preceding, collected by Hewitt, bears only the locality Sarawak and the native name "Rotan Sepal."

OBSERVATIONS.—When I first wrote the description of *D. sparsiflorus* I considered as one of its most prominent characteristics the female flowers not being distichally set on the axis of the spikelets, but spirally arranged all round it; but in this variety, which in every other respect agrees with the *forma typica*, the spikelets have plainly distichous flowers.

PLATE 101.—Daemonorops sparsiflorus VAR. sarawakensis *Becc.* Portion of the sheathed stem with an entire male spadix in flower, and another not yet open; upper portion of a leaf. From Hewitt's specimen in Herb. Kew, labelled "Rotan Sepal."

PLATE 102.—Daemonorops sparsiflorus VAR. sarawakensis *Becc.* (except the two spikelets with female flowers on the left side of the plate). Upper end of a leaf; an entire fruiting spadix: from the Baram specimen collected by Hewitt (Herb. Kew.). The two spikelets belong to the type specimens of *D. sparsiflorus* in Herb. Kew.

47. DAEMONOROPS SPARSIFLORUS var. CRASSIFOLIUS Becc. n. var.

DESCRIPTION—It differs from the *forma typica*, as well as from the variety *sarawakensis* in its larger leaves, with larger leaflets and of a thicker structure; in the dry condition, in herbarium specimens, the leaflets are brittle, and look as if they had been succulent when fresh. In the *forma typica* and in the variety *sarawakensis* they are also thickish, but not to such an extent as in the present variety. The largest leaflets are 35 cm. long and 18–20 mm. broad. The male spadices I have seen are not fully evolute, they are however exactly like those of var. *sarawakensis* in respect of the structure of the spathes, but of these the outermost, which is 20 cm. long and 22 mm. broad, almost completely enwraps all the others; it is flattish or somewhat concave on the axial side, convex on the back, and bears, besides the long bristles at the apex, a few feeble, flaccid spines on its acute edges. It is not known if in fully evolute spadices the inner spathes protrude beyond the outermost, as in var. *sarawakensis* or if these remain always the shortest. If this be really the case, it would be, perhaps, convenient to raise this variety to the rank of a species. The male spikelets and the male flowers are identical with those of var. *sarawakensis.*

HABITAT—Dutch N.-W. Borneo at Liang-gagan in the Residency of Sambas (*Hallier* No. 2989 in Herb. Hort. Bot. Bogor.).

PLATE 103.—Daemonorops sparsiflorus VAR. crassifolius *Becc.* The summit of a plant with a male, not yet open, spadix; a male spadix very near flowering; portion

of the sheathed stem; lower and intermediate portion of a leaf. From Hallier's type specimen in Herb. Bogor.

50. Daemonorops microstachys Becc.

This species, which was known only through very incomplete specimens collected by Lobb near Bruni, has been found again by H. Hallier in Dutch N.-W. Borneo at Sungei Sambas, in the homonymous Residency (No. 1086 in Herb. Hort. Bot. Bog.). The specimens from this locality appear to have the same characteristics as those from W. Borneo, and seem to exclude the hypothesis that *D. microstachys* represents a case of nanism of *D. Hystrix.* These specimens reveal a small, very slender, erect plant. The *sheathed stem* is 15–18 cm. in diam., the naked canes 8 mm. thick; the leaf-sheaths are split open a long way down on the ventral side, and are armed, more or less distinctly, with obliquely-seriate, rather large, laminar spines, and smaller series of minute spiculae. *Leaves* never cirriferous in the specimens seen by me, about 80 cm. long; petiole subterete, armed with scattered, robust, 2–4 cm. long, straight spines; leaflets numerous, equidistant, linear-lanceolate; the largest 20–22 cm. long, 11–12 mm. broad, bristly on 3 nerves on the upper surface, but only on the mid-costa on the lower. *Spadices* axillary, very slender, about 15 cm. long on the whole; the panicle very small, short, and with very few branchelets, borne on a slender flattened spinulous pedicellar part; the outermost spathe is spathulate, coriaceous, bidentate at the apex, about 5 cm. long, spinous on a dorsal central carina; the lowest internode of the flowering panicle is distinctly clavate; the partial inflorescences are very small, and have a very few, very short, few-flowered spikelets. *Fruit* globular, 9 mm. in diam., terminating in a very short broadly-conical, acute beak; scales almost polished, of a cinnamon-brown colour, with a narrow light-coloured marginal line, neatly and narrowly grooved along the centre; the margins very minutely erose-ciliate. *Seed* globular.

Plate 104.—Daemonorops microstachys *Becc.* The upper part of a leafy stem; portion of a sheathed stem with an entire leaf and one spadix *in situ*, with immature fruits; spadix with mature fruits. From Hallier's No. 1086 in Herb. Hort. Bot. Bogor.

51. Daemonorops hystrix var. exulans Becc. n. var.

Description.—Slender (scandent?). *Sheathed stem* 1–1·5 cm. in diameter. *Leaf-sheaths* striate longitudinally, armed on the body with scattered, narrowly-laminar, 1–2 cm. long spines, and more or less furnished on the ventral side of their upper part, along the centre, with rigid, horizontal, blackish, needle-like spiculae, 1–1·5 cm. long, which become slightly broader and are, at most, 3–4 cm. long on the margins of the mouths of the leaf-sheaths, where they are ascendent or spreading, and never attain the extraordinary size observed in the *forma typica*, or in its variety *minor*. In other respects, the var. *exulans* of *D. Hystrix* does not differ from its var. *minor* except in its still smaller dimensions. The leaves are from

20 to 40 cm. long in the pinniferous part, the petiole is much flattened, and slightly prickly, or almost smooth, on the edges; the leaflets are 10–20 cm. long, 5–12 mm. broad, very closely and minutely bristly on 3 nerves beneath; the cirrus is 15–20 cm. long. *Spadix* 10–30 cm. long. *Fruit* ovoid, with a broadly-conical acute apex, about 15 mm. long, 10 mm. broad.

HABITAT.—Dutch N.-W. Borneo. Liang-gagang in the Residency of Sambas. (*Hallier's* Nos. 2759 and 2596 in Herb. Hort. Bot. Bogor.).

OBSERVATIONS.—Distinguishable from var. *minor* by the armament of the mouths of the leaf-sheaths, where the unusually long, erect spines, peculiar to all other forms of *D. Hystrix* are wanting.

PLATE 105.—Daemonorops Hystrix VAR. exulans *Becc.* Portion of the plant with nearly mature fruits, on the right hand side of the plate; from Hallier's No. 2759 (Herb. Hort. Bot. Bogor.). Portion of the sheathed stem and a spadix with immature fruits; portion of a sheathed stem with 2 male spadices, one in flower, the other not yet open: from Hallier's No. 2596 (Herb. Hort. Bot. Bogor.).

68*bis*. (88) DAEMONOROPS TURBINATUS Becc. n. sp.

DESCRIPTION.—Scandent, of moderate size. *Sheathed* stem 1·5–2·5 cm. in diam. *Leaf-sheaths* strongly gibbous above, obliquely truncate at the mouth, which is fringed with many long criniform spiculae; the gibbosity is almost polished, and usually quite unarmed; immediately below the gibbosity the leaf-sheaths are furnished with one or two pairs of large, complete, membranous, almost equally broad, approximate and decussating spiniferous collars, between which follow several other collars, more or less complete, with a sometimes rather broad, sometimes narrow, or even rudimentary membranous part turned in opposite directions, but not paired. The surface of the sheaths between the collars is glabrous and almost polished; the edges of the collars are armed with several, spaced, very long and slender, flat, elastic, brown or spadiceous spines, and between these with innumerable, blackish, minute spiculae. *Leaves* rather large, cirriferous; the petiole is biconvex, except in its lowest part, where it is flattish, or slightly concave on its upper surface, and convex on the back; the edges are rather obtuse and, armed with small, short prickles, occasionally slightly reversed; the dorsum along the centre is smooth, or but sparingly prickly; the rachis has its upper surface rather broad, flattish or slightly convex in its lowest part, with an acute salient angle and flat side faces towards the end; on the lower surface, the rachis is polished and armed along the centre with a line of solitary claws which become ternate towards the end, and on the cirrus. Leaflets not very numerous, very inequidistant, and more or less distinctly approximated into 3–4 groups, separated by vacant spaces of very unequal lengths; the lowest group has 3–5 leaflets on each of the rachis inserted at an angle of about 45° and spaced 5–10 mm., or at times 2–3 cm. apart; in the upper groups the leaflets are more and more irregularly spaced; the leaflets are ensiform, or narrowly-lanceolate, broadest about their middle, and thence almost equally tapering towards both ends; their base is narrow and acute, and the apex is slightly bristly, especially on a small indentation at the beginning of the tail-like tip, which terminates in a filament; they are firmly papyraceous, distinctly 3-costulate, on the upper surface the side costae are almost as strong as the mid-costa, all three are very minutely yet sparingly spinulous; on the lower surface the costae are not prominent and these, like the other nerves, are quite smooth; transverse veinlets extremely numerous and approximate, very sharply and equally defined on both surfaces; the margins are very minutely spinulous, the lower margin is bordered on the upper surface with a broad, polished, and glossy band; the largest leaflets are the medials of the lowest group; they average 40 cm. in length and 3 cm. in breadth. *Male spadix* . . . . *Female spadix* diffuse when in fruit, apparently not very large, it has several partial inflorescences distichally inserted, and kept horizontal by a conspicuous axillary callus; primary spathes not seen by me; the main axis is rigid, covered with a thin partially deciduous rusty-furfuraceous indumentum; the internodes are 5–7 cm. long, the lowermost subterete, 6–8 cm. in diameter the others very unevenly surfaced; secondary spathes reduced to a narrow uniform ring; partial inflorescences 11–15 cm. long, their axis rigid, with short internodes and 4–5 spikelets on each side; tertiary spathes shortly annular, but produced at one side into a very short acute point; spikelets kept horizontal by a conspicuous axillary callus; the lower of each inflorescence is 7–8 cm. long, and has very few distant distichous flowers (4–5 on each side); the upper spikelets gradually shorter, and with fewer flowers; the axis of the spikelets is rusty-furfuraceous, sinuous, and acutely angular; the spathels have a very short annular limb, and are produced, at one side, into a broadly triangular acute point; involucrophorum very distinctly pedicelliform, 5–7 mm. long, spreading, with a conspicuous axillary callus, acutely angular, subobpyramidate, broadening considerably towards its upper end, which is edged by a very narrow rim; involucre orbicular, flat, almost on a level with the involucrophorum, and edged by an extremely narrow rim; areola of the neuter flower inconspicuous, pit-like. *Fruiting perianth* obconical, pedicelliform with a very hard base; the calyx is cyathiform with a flat hard base, rusty-furfuraceous, obsoletely veined, broadly 3-toothed; the corolla is more than twice as long as the calyx, the segments triangular, acuminate; from the perianth I estimate the female flowers about 6 mm. long. *Fruit* distinctly turbinate from a regularly round, or slightly depressed top, which is crowned by the remains of the sessile stigmas: it tapers to an acute base, is 2 cm. long on the average and 15 mm. broad; pericarp hard and not brittle; scales arranged in 15 longitudinal series, deeply grooved along the centre, of an uniform hazel-nut colour, rather glossy, conspicuously convex, with a re-entering obtuse point. *Seed* (immature).

HABITAT.—N.-W. Dutch Borneo at Liang-gagang in the Residency of Sambas; discovered by *H. Hallier*, 1893-94 (No. 3042 in Herb. Hort. Bot. Bogor.). Native names "Rotan djelapang". No. 2595 of the same collector is represented by sterile specimens from young plants.

OBSERVATIONS.—It is a very fine species, which the uncommon form of its fruit renders quite distinct. In all the other species of the group of *D. mirabilis*, of which the fruit is known, this is spherical; but several species of that group are known only from their vegetative organs.

In the peculiarities of its leaf-sheaths *D. turbinatus* seems to approach *D. mirabilis* more closely than other species; but in the latter the pairs of membranous collars are more numerous and all are complete. From *D. mirabilis* var. *oligocyclis* it differs in the different arrangement of the leaflets which, in that species, are more distinctly grouped than in *D. turbinatus*.

PLATE 106.—Daemonorops turbinatus *Becc.* Lower portion of a leaf; portion of the sheathed stem; longitudinal section of the upper part of a leaf-sheath, seen from the inner side; the fruiting spadix almost entire. From Hallier's No. 3042 in Herb. Hort. Bot. Bogor.

74*bis*. (89) DAEMONOROPS ASTERACANTHUS Becc. sp. n.

DESCRIPTION.—Scandent, slender. *Sheathed stem* about 15 mm. in diam. *Leaf-sheaths* slightly gibbous above, beautifully armed at almost regular intervals of about 1 cm. with complete circular rows of broad, almost lanceolate, very thinly laminar, spadiceous or blackish spines, with which are intermingled numerous very slender spiculae; both spines and spiculae are deflexed and united by their bases to form several narrow, horizontal rings all round the sheaths from which they radiate; the largest spines are 1–2 cm. long and 1–2 mm. broad, frequently abruptly acuminate: the mouth of the leaf-sheath is densely armed with similar, but much longer, and more gradually acuminate spines. *Leaves* cirriferous, 40–50 cm. long in the pinniferous part; the petiole is elongate, 30–35 cm. long, 4–5 mm. broad, slightly flattened-biconvex, with rather sharp edges, which are rather closely armed with straight, often 3-nate-digitate spines; the lower spines are 10–15 mm. long, the upper very short; the dorsum of the petiole is either smooth or armed with a few straight deflexed spines; the rachis becomes bifaced on the upper surface and has an acute salient angle, starting from its base just where the lowest leaflets are inserted: on the back it is armed throughout, rather closely, and at regular distances, with 3-nate claws; the cirrus is equally armed with ternate, or, at times, quinate, claws; leaflets very distinctly approximate into 3–4 groups, which are separated by vacant spaces 8–12 cm. long; the groups are formed by [illegible]–4 leaflets on each side of the rachis, very approximate by their bases and inserted at a very acute angle; the leaflets are quite bare on both surfaces and on the margins, are firmly papyraceous, somewhat plicate longitudinally, almost glossy on both surfaces, more or less narrowly lanceolate, not very gradually but almost equally diminishing towards both ends; their base is acute, the apex acuminate and almost pungent, not, or very slightly bristly-spinulous; the largest leaflets are those of the intermediate groups, and are 12–18 cm. long, and 18–20 mm. broad; those of the lowest group are somewhat narrower and at times longer, and those of the uppermost group, which is reduced to only 2–3 leaflets, are the smallest; the mid-costa is slender, very sharp on the upper surface; secondary nerves very faint; transverse veinlets not very conspicuous, translucid, moderately numerous. *Spadix* (seen only in a very young stage) apparently axillary, very slender, cylindraceous before flowering, borne on a rather short, slender, strongly flattened, unarmed, peduncular part. *Spathes* all entirely unarmed, tubular, the one gradually protruding beyond the other; the outermost prolonged into a triangular, acuminate, dorsally-keeled bare point.

HABITAT.—Dutch West Borneo, but the exact locality and the name of the collector not known, probably *Teijsmann*. One specimen in the Herbarium at Buitenzorg bears the number 16713 and the native name "Rotan besie" (= the iron Rotang), and another the number 16331 and the native name "Rotan asik."

OBSERVATIONS.—Apparently the affinities of *D. asteracanthus* are to the species of the group to which *D. mirabilis* belongs, but it is rendered quite distinct from any other species known to me by several conspicuous characteristics and especially by the radiately-stellate armament of the leaf-sheaths, the distinctly grouped lanceolate and quite smooth leaflets, and by the small spadices with quite unarmed spathes.

PLATE 107.—Daemonorops asteracanthus *Becc.* Upper portion of a leafy stem with a young spadix at its summit; from No. 16331: two portions of the leaves from No. 16713 (Herb. Hort. Bot. Bogor.).

82*bis*. (90) DAEMONOROPS SPECTABILIS Becc. sp. n.

DESCRIPTION.—Apparently large and scandent. *Leaf-sheaths* woody, very formidably armed with unequal, frequently very large, laminar, dagger-shaped, brown spines, which are confluent by their bases, and arranged in oblique rows; some of the spines are as much as 6 cm. long, and 5–6 mm. broad at their bases. *Leaves* large; those of the upper part of the plant terminated by a very robust cirrus which is armed, like the upper part of the rachis, with half or nearly three-quarter whorls of very stout claws, confluent in groups of 5–7 by their considerably swollen bases; on the upper surface the rachis has a very acute, smooth, salient angle, and flat side faces; petiole . . . . ; leaflets very inequidistant, more or less grouped, with long vacant spaces between the groups, which are formed by 2–3 not very approximate leaflets (3–6 cm. apart) on each side of the rachis; the leaflets are firmly papyraceous, almost glossy and quite bare of spinules or hairs on both surfaces, more or less plicate longitudinally, narrowly lanceolate, broadest about their middle, tapering thence lower down towards a rather acute base, and in the upper part to a rather abruptly acuminate, caudiculate, bristly-spinulous tip; they appear unicostate as they have the mid-costa acute on the upper surface and all the secondary nerves unequal, but slender; transverse veinlets extremely minute, short and numerous, much immersed in the parenchyma; margins minutely spinulous. *Male spadix* . . . *Female spadix* erect, rigid, strict; the panicle is 30–40 cm. long, sometimes shorter, cupressiform, composed of 7-8 small, appressed partial inflorescences and borne on a strongly flattened pedicellar part apparently not quite as long as the panicle, 6–10 mm. broad, thinly furfuraceous and more or less armed on the rather acute edges with straight, often digitate horizontal spines; primary spathes lanceolate, very acuminate, papyraceous, dry, easily splitting longitudinally, equally brown and dull on both surfaces; the outermost spathe is rather acutely two-keeled with the keels spinulous, otherwise it is smooth, shorter than the inner ones; of these the second is about 25 cm. long and about 3 cm. broad and has a few spinules on a dorsal keel; the others, although shorter than the second, are slightly protruded one beyond the other, and are quite smooth; the main axis is straight, absolutely angular, thinly furfuraceous, unevenly surfaced, with internodes 2·5–4 cm. long; partial inflorescences shorter than their respective spathes, the lower, which are the largest, are 10–14 cm. long, and carry alternately 2 or, at most, 3 spikelets on each side; they are at first quite appressed to the main axis, and only very slightly spreading or inserted at a very acute angle when loaded with fruits; are slightly callous at their axillas but have a deep transverse rima; the axes of the partial inflorescences are flattish on the axial side and have acute edges; secondary spathes membranous, tubular in their basal part and produced above into a triangular acuminate point; the spikelets are short, have few flowers and an acutely trigonous axis; the largest spikelets are 5–6 cm. long, and have only 3–4 female flowers on each side; spathels membranous, striate, dry, very shortly tubular, produced at one side into a triangular point, which at first embraces its respective female and neuter flower, and is soon destroyed; each female flower is as usual accompanied by a neuter flower, but this is only slightly smaller than the female, and therefore 2 almost equal flowers spring from each spathel in the spikelets before the anthesis; involucrophorum sessile, membranous, obliquely cupular; involucre also obliquely cupular, membranous and similar to the involucrophorum, in which it is immersed; areola of the neuter flower conspicuous, flattish, ovate and with well-defined edges. *Female flowers* conical, very acute, relatively large, about 1 cm. long; the calyx finely striately veined, broadly and deeply 3-lobed, later split into 3 parts down to the base; the corolla twice as long as the calyx, its segments triangular, acuminate and almost pungent; staminal urceolum conspicuous and thickish, crowned by 6 short teeth, and by triangular anthers. *Neuter flowers* very similar to the female, but somewhat smaller; they have a rather well conformed staminal urceolum and anthers, but an abortive ovarium. *Fruiting perianth* not pedicelliform, but not quite explanate under the fruit. *Fruit* regularly ovoid or sub-obovoid, very shortly, broadly and conically beaked, about 2 cm. long and 12–13 mm broad; scales broader than long with a round point, arranged in 15 longitudinal series, each series of about 10, not reckoning the very small ones at both ends, very shallowly-grooved along the centre, dull brown, edged with a narrow, uniform, almost black, intramarginal line all round; the extreme margin very minutely fringed and ciliated. *Seed* not seen when quite mature.

HABITAT.—N.-W. Dutch Borneo at Liang-gagang, in the Residency of Sambas; discovered by *H. Hallier* in 1893-94 (No. 2797 in Herb. Hort. Bot. Bogor.).

OBSERVATIONS.—This is a very fine and quite distinct species, apparently somewhat related to the species which have membranous spathes, such as *D. longipes* and *D. longispathus*. The portions of leaves which accompany the spadices in the Buitenzorg Herbarium evidently belong, in part, to the leaves of the upper part of a climbing plant, as they terminate in a long and very powerfully clawed cirrus; but in part are radical, or taken from a young plant, having only a rudimentary cirrus at their ends. The leaflets however are equal in all.

PLATE 108.—Daemonorops spectabilis *Becc.* A female spadix just before the anthesis; entire panicle with nearly mature fruits; an entire female spadix with

growing ovaries; portion of a sheath probably from a radical leaf: from Hallier's specimen No. 2797 in Herb. Hort. Bot. Bogor.

83 *bis*. (91) DAEMONOROPS FLORIDUS Becc. sp. n.

DESCRIPTION.—Apparently scandent and rather large. *Sheathed stem* about 5 cm. in diameter. *Leaf-sheaths* strongly armed with laminar, light-coloured spines, of which some, especially those near the mouth, are very large (as much as 4–5 cm. long and 5–6 mm. broad) finely subulate to a sinous, or wavy, or, at times, bipartite point; mixed with these are many others, much smaller, but of the same shape. The *leaves* seem very large. The portion of one seen by me is of the upper part, and this terminates in an extraordinarily robust cirrus, very regularly armed with half-whorls of very robust claws, 5–7 in number, which are highly connate into a light-coloured swollen base, and have short, very sharp, black points; the rachis on its upper surface has a not very acute, smooth, salient angle, with flat side faces, on the lower surface it is strongly convex and armed like the cirrus; the leaflets are distinctly but irregularly grouped, separated by variable, at times rather long, vacant spaces; they are inserted at a rather acute angle, and, in the groups, are 2–5 cm. apart; they are very firmly papyraceous and rigid, coarsely plicate longitudinally, quite bare of spinules or bristles, and almost glossy on the upper surface; slightly paler, dull, and also quite smooth, on the lower; lanceolate, unicostate, and with 2–3 slender, although sharp nerves on each side of the mid-costa; broadest about their middle, and tapering thence at once upwards to a very gradually acuminate and long point, and downwards to an acute base; the margins are very remotely and inconspicuously spinulous; transverse veinlets inconspicuous, being immersed in the parenchyma; the largest leaflets seen by me are 30–35 cm. long, and about 3 cm. broad: those nearer to the cirrus are smaller. *Male spadix* . . . . . *Female spadix*, in one specimen, is 1·5 m. long, very narrow, the panicle is formed by 10–11 gradually diminishing partial inflorescences, is borne on a robust, rigid, flattened pedicellar part which is about 15 cm. long, 2 cm. broad, strongly flattened, and acutely two-edged, the edges armed with straight, spreading spines; the main axis is subterete or obsoletely angular, and slightly flattened, especially in its upper part; the internodes are 8–10 cm. long, not swollen at the junctures, and not marked by irregularities caused by the pressure of the adjoining parts; primary spathes thinly coriaceous: the outermost not seen by me: the inner are at first tubular, each protrudes considerably beyond the other; later they split longitudinally, and are more or less spread open, 25–30 cm. long, about 3 cm. broad, their apex triangular, dull on both surfaces, of a general red-brown colour, glabrous, and finely striate inside, fugaciously-rusty-furfuraceous externally, quite unarmed: partial inflorescences cupressiform; the lower are 10–12 cm. long, have the axes rigid, and the internodes short; the lowest internode is flattened, and the others, especially towards the apex, are sinuous; the spikelets are 6–8 in number on each side of the axes, and speedily decrease in length and number of flowers from the base towards the apex of the partial inflorescences; secondary spathes thinly membranous, dry, reddish-brown, shortly tubular-infundibuliform, considerably produced at one side into a triangular acuminate point; the spikelets are rigid, and have a strongly zig-zag sinuous, angular axis; spathels shortly, broadly and unilaterally infundibuliform, produced at one side into a very short, broadly-triangular point; involucrophorum conspicuously pedicelliform, 3–5 mm. long. angular, broadening upwards, and expanded into a short, obliquely-evolute limb; involucre very shallowly and unilaterally cupular, truncate, obsoletely bidentate on the side of the neuter flower, of which the areola is rather conspicuous, ovate, niche-like, and with sharp edges; the lower spikelets are 8–10 cm. long, and have 8–10 flowers on each side; the others speedily decrease in length and number of flowers; the uppermost are 2–3 cm. long and have 6–8 flowers only. *Female flowers* ovoid, bluntish; the calyx tubular-cyathiform, very shallowly and obsoletely 3-toothed, very minutely striately-veined; the corolla twice as long as the calyx. *Neuter flowers* very similar to the female, but somewhat smaller. All the axial parts of the spadix are covered with a conspicuous rusty-furfuraceous indumentum. *Fruits* unknown.

HABITAT.—Borneo: in Sarawak at Kuching (*J. Hewitt* in Herb. Kew.).

OBSERVATIONS.—A beautiful species, rather closely related to *D. acamptostachys*, from which it differs in the very elongate spadix, and in the spikelets, which have the flowers borne on a conspicuous involucrophorum, whereas this part is short, and only slightly protruded beyond its own spathel in *D. acamptostachys*.

PLATE 109.—Daemonorops floridus *Becc.* Upper end of a leaf; upper portion of a leaf-sheath; an entire female spadix (in two pieces) with not yet open flowers; the pedicellar part of this same spadix is attached to the upper end of its leaf-sheath: from Hewitt's typical specimen in Herb. Kew.

Imperfectly known, doubtful or excluded species.

DAEMONOROPS ACICULATUS Ridley, Mat. Fl. Mal. Pen. ii, 176.

I have not seen specimens of this *Daemonorops* of the section *Cymbospatha*, which would seem to be closely related to *D. imbellis* Becc., if not identical with it, on account of its spadix furnished with a peduncular part 4 inches long, and an ovoid fruit, over an inch long. I do not know, however, of any *Daemonorops* with scales in "8 rows"; perhaps the author means that there are 8 scales in each longitudinal row.

I reproduce here Ridley's description:—

"Leaves 4–6 feet long, petiole 6 inches long, thickly sprinkled with short, sharp
"spines on all sides; leaflets narrow linear acuminate, close equidistant, alternate and
"sub-opposite, 8–10 inches long, $\frac{3}{4}$ inch wide, margins, and 3 nerves, and tip, bristly
"with rather long pale bristles. Spathe thin, fusiform, tapering at the base into a 4
"inches long peduncle, thickly armed with pale, flat, narrow spines; body of spathe thickly
"armed with very narrow spines, flat and greenish, $\frac{1}{8}$ to $1\frac{1}{2}$ inch long, solitary and
"in rows; limb of spathe 8 inches long, $1\frac{1}{2}$ inch wide, ending in a nude point 3
"inches long; inner spathes papery unarmed. Male panicle 6 inches long, dense,
"branches flexuous, hairy. Bracts orbicular, cuspidate, ribbed Calyx tubular, cup-

"shaped with three distinct lobes, short; corolla twice as long, lobes oblong. Female "spadix in fruit 6 inches long. Fruit obovoid, shortly beaked, over an inch long, "yellowish brown. Scales in 8 rows, edged with dark brown, broader than long, "sub-triangular, deeply grooved. Seed round, very rugose and warted, deeply pitted."

Perak, Larut Hills to the top (*Ridley*).

DAEMONOROPS CALOSPATHA. Ridley Mat. Fl. Ma. Pen. ii, 179.
Calospatha Scortechinii Becc. ms.

The description given by Ridley (l.c.) of this Palm. exactly agrees with a fruiting spadix, existing in my herbarium, and collected by Scortechini in the district of Perak. Of this specimen a drawing was sent by me to Kew, under the name of *Calospatha Scortechinii*, together with my manuscript notes for the "Flora of British India", wherein, however, this Palm was not included.

Mr. Ridley gives also the description of the leaves of his *Daemonorops calospatha*, but there is not the required evidence that these are really those of the fruiting spadix which he describes.

Calospatha Scortechinii is a very curious and distinct Palm, more related to *Plectocomia* than to *Daemonorops*, distinguishable from the first especially by its very short spadix, and from the second by the distichous, very peculiar, primary spathes and by the fruit containing 3 seeds.

I hope to be able to give later a figure and a detailed description of *Calospatha*, when working on the other genera of the Asiatic *Lepidocaryeae*.

DAEMONOROPS DIVERSISPINUS Becc. in Rec. Bot. Surv. Ind. ii, 229.

This species must be eliminated, as it was founded by me upon a spadix of *D. cristatus* and a portion of a leaf of *Calamus ferrugineus*, which were together on the same sheet in the Calcutta Herbarium. See observations to *Daemonorops cristatus*.

DAEMONOROPS ERINACEUS Becc. in Rec. Bot. Surv. Ind. ii, 225.

I now consider this as a species of *Calamus* (*C. erinaceus* Becc.).

DAEMONOROPS CARCHARODON Ridley, Mat. ii, 178.

See observations to *D. angustifolius*.

DAEMONOROPS CONGESTA Ridley, Mat. ii, 179.

See observations to *D. leptopus*.

DAEMONOROPS SCANDENS Bl.; Name quoted by Rosenth. Syn. pl. diaphor., 1093, as from Baill. Hist. des Plantes, xiii, 300—*Quid*?

DAEMONOROPS ADSCENDENS Bl. (written "*D. ascendens* Bl.; *Rotan-Pella*" in the note) Baillon, Hist. des Plantes, xiii, 300, is evidently a mistake for *D. accedens* Bl. = *D. ruber* Reinw.

Description of analytical Plates.

Plate I.

The letters indicate the organs as follow:—

(*a*) Corolla.
(*b*) Calyx.
(*c*) Staminal urceolum.
(*d*) Involucre.
(*d′*) Areola of the neuter flower.
(*d″*) Point of insertion of the neuter flower.
(*e*) Involucrophorum.
(*e′*) Pedicellar part of the involucrophorum.
(*f*) Spathella.
(*g*) Chalaza.
(*h*) Embryo.
(*i*) Micropyle.

All the figures represent analyses of *Daemonorops Jenkinsianus* Mart. Figs. 9–10 enlarged 4 diameters, the others 7 diameters.

Fig. 1.—Female flower during the anthesis, seen from the outer side, and showing the areola of the neuter flower (*d′*) and that portion of the axis with the spathel (*f*) which carries the flower immediately over it.

Fig. 2.—The same; seen from the axial side.

Fig. 3.—The same; without the involucra and the corolla.

Fig. 4.—The same; without calyx and corolla, and showing the staminal urceolum with abortive anthers.

Fig. 5.—Female flower with involucra, cut longitudinally.

Fig. 6.—Neuter flower without the calyx, and the third portion of the corolla.

Fig. 7.—A young fruit with the involucra and its axial part.

Fig. 8.—The same cut longitudinally: it shows the ovulum in course of development, enwrapped by a gelatinous, amorphous substance which causes depressions on its surface: internally the embryo sac shows several round papillae that are the beginning of the channels which cause the rumination of the seed.

Fig. 9.—Mature fruit, cut longitudinally along the line of the raphe and through the embryo.

Fig. 10.—The same in cross section; externally are the scales; the second thin layer is the mesocarp with the section of the fibro-vascular bundles; the following dark layer represents the amorphous, gelatinous matter; next comes the fleshy integument of the seed, in which are formed lysigenic cavities filled with tannic matter, and inside of it an internal layer of the integument, consisting of cellules normal to the surface of the seed, from which are derived the channels which penetrate into the substance of the albumen.

PLATE II.

FIGS. 1–5.—Daemonorops Jenkinsianus *Mart.*

FIG. 1.—Female spikelet, slightly enlarged.

FIG. 2.—Male spikelet (×4).

FIG. 3.—Portion of the axis of a male spikelet, showing the cup-shaped involucre at each spathel (×7).

FIG. 4–5.—Male flowers (×7).

FIGS. 6–7.—Daemonorops verticillaris *Mart.*

FIG. 6.—Male spikelet; *e* spathel, *d* involucre (×7).

FIG. 7.—Male flower spread open; *f* abortive ovary; *g* nectariform bodies (×15)

FIGS. 8–10.—Daemonorops longispathus *Becc.*

FIG. 8.—Upper part of a female spikelet with female (*a*) and neuter flowers (*b*) in situ, *e* areola of the neuter flower (×7).

FIG. 9.—Female flower (×7).

FIG. 10.—Portion of a spikelet with female flowers during the anthesis; *e* areola of the neuter flower (×7).

INDEX TO SPECIES.

Species or varieties described for the first time are in bold type.
Synonyms and "nomina nuda" are in italics.

Page.

C

Calamus acanthopis Griff. 61
——— *accedens* Miq. 114
——— *amboinensis* Miq. 164
——— *angustifolius* Griff. 69
——— *Calapparius* Mart. 164
——— *calicarpus* Griff. 94
——— *cochleatus* Miq. 123
——— *crinitus* Miq. 172
——— *depressiusculus* Miq. 155
——— ——— T. & B. 155
——— *Draco* Griff. 111
——— ——— Willd. 105
——— *elongatus* Miq. 139
——— *extensus* Roxb. 41
——— *fissus* Miq. 65
——— *Gandichandii* H. Wendl. 157
——— *geniculatus* Griff. 186
——— *gracilipes* Miq. 118
——— *grandis* Griff. 58
——— *grandis* Kurz. 60
——— *hirsutus* Miq. 135
——— *hygrophilus* Griff. 62
——— *Hystrix* Griff. 135
——— *intermedius* Griff. 73
——— *Jenkinsianus* Griff. 41
——— *Korthalsii* Miq. 148
——— *leptopus* Griff. 128
——— *Lewisianus* Griff. 87
——— *longipes* Griff. 202
——— *macropterus* Miq. 98
——— *manicatus* T. & B. 172
——— *Margaritae* Hance. 66
——— *melanochaetes* Miq. 47
——— *micracanthus* Griff. 110
——— (?) *mirabilis* Mart. 175
——— *monticolus* Griff. 84, 85
——— *niger* Willd. 104
——— *nutantiflorus* Griff. 41
——— *oblongus* Reinw. 144
——— *palembanicus* Miq. 51
——— *periacanthus* Miq. 197
——— *periacanthus* (non Mart.) Ridley 167
——— *petiolaris* Griff. 90
——— *platyacanthus* Mart. 144
——— *Riedelianus* Miq. 150
——— *Rotang* δ *Draco* Linn. 105
——— *ruber* Reinw. 114
——— *ruptilis* H. Wendl. 211
——— *strictus* Miq. 202
——— *tricnrous* Miq. 71
——— *usitatus* Blanco 157
——— *verticillaris* Griff. 166
Calospatha Scortechinii Becc. 231

Page.

D

Daemonorops **acamptostachys** *Becc.* 209
——— acanthobolus *Becc.* 192
Daemonorops accedens Bl. 114
——— ——— (non Bl.) Miq. 192
——— ——— VAR. *brevispatha* Bl. 118
——— *aciculatus* Ridley. 231
——— *adscendens* Bl. 232
Daemonorops angustifolius *Mart.* 69
——— annulatus *Becc.* 174
——— **aruensis** *Becc.* 50
——— **asteracanthus** *Becc.* 227
——— **bakauensis** *Becc.* 220
——— **Binnendijkii** *Becc.* 67
——— Calapparius *Bl.* 164
——— calicarpus *Mart.* 94
Daemonorops calicarpus Ridley 90
——— *calospatha* Ridley 231
——— *carcharodon* Ridley 69, 232
Daemonorops **Clemensianus** *Becc.* 163
Daemonorops cochleatus T. & B. 123
Daemonorops collariferus *Becc.* 183
Daemonorops congesta Ridley 129, 232
Daemonorops crinitus Bl. 172
——— cristatus *Becc.* 190
——— Curranii *Becc.* 142
——— depressiusculus *Becc.* 155
——— didymophyllus *Becc.* 123
Daemonorops dissitophyllus Becc. 197
——— *diversispinus* Becc. 190, 232
Daemonorops Draco *Bl.* 105
——— Draconcellus *Becc.* 108
——— elongatus *Bl.* 139
Daemonorops elongatus (non Bl.) Ridley 161
——— *erinaceus* Becc. 232
Daemonorops fissus *Bl.* 65
——— ——— VAR. cinnamomeus *Becc.* 67
——— **floridus** *Becc.* 230
——— Forbesii *Becc.* 179
——— formicarius *Becc.* 170
Daemonorops fuscus Mart. 167
Daemonorops Gaudichaudii *Mart.* 157
——— geniculatus *Mart.* 186
Daemonorops geniculatus VAR. *sphaerocarpus* Becc. 192
Daemonorops gracilipes *Becc.* 118
——— grandis *Mart.* 58
Daemonorops grandis Kurz. 60
——— *grandis* Ridley 73
Daemonorops **Hallierianus** Becc. 218
Daemonorops hirsutus Bl. 135, 144
——— ——— β *brevifolia* Bl. 135
Daemonorops hygrophilus *Mart.* 62

Page.
Daemonorops Hystrix *Mart.* 135
—— var. exulans *Becc.* . 224
—— var. minor *Becc.* . . 139
—— imbellis *Becc.* 80
—— intermedius *Mart.* . . . 73
—— var. nudinervis *Becc.* 75
—— Jenkinsianus *Mart.* . . . 41
—— ? var. tenassermicus *Becc.* . 44
—— Korthalsii *Bl.* 148
—— Kunstleri *Becc.* 151
—— Kurzianus *Becc.* 60
—— lamprolepis *Becc.* . . . 102
—— leptopus *Mart.* 129
—— Lewisianus *Mart.* . . . 87
—— Loherianus *Becc.* . . . 104
—— longipes *Mart.* 202
Daemonorops longipes (non Mart.) Miq. . . 118
Daemonorops longispathus *Becc.* . . . 206
—— macrophyllus Becc. . . . 185
—— macropterus *Becc.* . . . 98
—— malaccensis *Mart.* . . . 61
—— Manii *Becc.* 44
—— Margaritae *Hance* . . . 56
—— var. palawanicus *Becc.* 57
Daemonorops marginatus T. & B. . . . 67
Daemonorops mattanensis *Becc.* . . . 117
—— melanochaetes *Bl.* . . . 47
—— var. depresse-globosus *T. & B.* 49
—— var. macrocarpus *Becc.* 49
—— var. macrocymbus *Becc.* 49
—— var. microcarpus *T. & B.* 48
—— var. padangensis *Becc.* 49
—— micracanthus *Becc.* . . . 110
—— microstachys *Becc.* . . 133, 224
—— microthamnus *Becc.* . . 92
—— mirabilis *Mart.* 175
—— var. oligocyclis *Becc.* 176
—— monticolus *Mart.* . . . 84
Daemonorops monticolus Griff. 85
Daemonorops monticolus var. pinangianus *Becc.* 85
Daemonorops monticolus var. β Becc. . . 85
Daemonorops Motleyi *Becc.* 120
—— niger *Bl.* 104
Daemonorops nutantiflorus Mart. . . . 41
Daemonorops oblongus *Bl.* 144
—— ochrolepis *Becc.* 160
—— var. radulosus *Becc.* . . 162
Daemonorops oligophyllus *Becc.* . . . 182
—— oxycarpus *Becc.* 131
—— var. levipes *Becc.* . 133
—— pachyrostris Becc. . . 217
—— palembanicus *Bl.* . . . 51
—— var. bangkanus *Becc.* 51
—— periacanthus *Miq.* . . . 197
Daemonorops periacanthus (non Mart.) Ridley . 166
Daemonorops petiolaris *Mart.* . . . 90
Daemonorops petiolaris var. *nudipes* Becc. . 90
Daemonorops Pierreanus *Becc.* 54
Daemonorops platyacanthus Mart. . . . 144
Daemonorops propinquus *Becc.* . . . 111
—— pseudo-mirabilis *Becc.* . . . 177
—— pseudo-sepal *Becc.* . . . 79
—— Riedelianus *Becc.* 150
—— robustus *Warb.* 101
—— ruber *Bl.* 114
—— ruptilis *Becc.* 211
—— Sabut *Becc.* 181
—— Sarasinorum *Warb* . . . 100
Daemonorops scandens Bl. 232
Daemonorops scapigerus *Becc.* 195
—— var. minor *Becc.* . . 197
—— Schmidtianus *Becc.* . . . 52
—— Scortechinii *Becc.* . . . 81
—— Sepal *Becc.* 77
Daemonorops Sepal var. *sphaerocarpus* *Becc.* . 81
Daemonorops singalanus *Becc.* . . . 82
—— sparsiflorus *Becc.* . . . 126
—— var. crassifolius *Becc.* . 223
—— var. sarawakansis *Becc.* 221
—— spectabilis *Becc.* . . . 228
—— stenophyllus *Becc.* . . . 64
Daemonorops strictus Bl. 202
Daemonorops tabacinus *Becc.* 93
—— Treubianus *Becc.* . . . 75
—— trichrous *Miq.* . . . 71
—— turbinatus Becc. . . . 225
—— ursinus *Becc.* 96
—— vagans *Becc.* 153
—— verticillaris *Mart.* . . . 166
—— virescens *Becc.* . . . 201
Drakensbloeds Rottang Valentyn . . . 106

P

Palmijuncus Calapparius Rumph . . . 164
—— *Draco* Rumph . . . 106, 114
—— *niger* Rumph . . . 104
—— *Palimbanicus* Rumph . . . 51

R

Rotang Dsjernang Kaempf. 106
—— *Kertong* Griff. 61
—— *longipes* Baill. 202
—— *periacanthus* Baill. 197

INDEX TO PLATES.

PLATE.
Daemonorops acamptostachys *Becc.* 96
—— acanthobolus *Becc.* 85, 86
—— angustifolius *Mart.* 18
—— annulatus *Becc.* 72
—— aruensis *Becc.* 5
—— asteracanthus *Becc.* 107
—— bakauensis *Becc.* 100
—— Binnendikyi *Becc.* 17
—— calicarpus *Mart.* 34
—— Clemensianus *Becc.* 67
—— collariferus *Becc.* 79
—— crinitus *Bl.* 71
—— cristatus *Becc.* 83, 84
—— Curranii *Becc.* 58
—— Draconcellus *Becc.* 42
—— depressiusculus *Becc.* 63
—— didymophyllus *Becc.* 49, 50, 51
—— elongatus *Bl.* 57
—— fissus *Bl.* 15
—— fissus VAR. cinnamomeus *Becc.* 16
—— floridus *Becc.* 109
—— Forbesii *Becc.* 76
—— formicarius *Becc.* 70
—— Gaudichaudii *Mart.* 64
—— geniculatus *Mart.* 81, 82
—— gracilipes *Becc.* 48
—— grandis *Mart.* 11
—— Hallierianus *Becc.* 99
—— hygrophilus *Mart.* 13
—— Hystrix *Mart.* 55
—— Hystrix VAR. exulans *Becc.* 105
—— Hystrix VAR. minor *Becc.* 56
—— imbellis *Becc.* 26
—— intermedius *Mart.* 20, 21
—— intermedius VAR. nudinervis *Becc.* 22
—— Jenkinsianus *Mart.* 1
—— Korthalsii *Bl.* 60
—— Kunstlerii *Becc.* 61
—— lamprolepis *Becc.* 40
—— leptopus *Mart.* 52
—— Lewisianus *Mart.* 30
—— Loherianus *Becc.* 41
—— longipes *Mart.* 92, 93
—— longispathus *Becc.* 94, 95
—— macrophyllus *Becc.* 80
—— macropterus *Becc.* 36, 37
—— malaccensis *Mart.* 12

PLATE.
Daemonorops Manii *Becc.* 2
—— Margaritae *Hance* 9
—— Margaritae VAR. palawanicus *Becc.* 10
—— mattanensis *Becc.* 47
—— melanochaetes *Bl.* 3
—— melanochaetes VAR. macrocymbus *Becc.* 4
—— melanochaetes VAR. microcarpus *T. et B.* 4
—— microstachys *Becc.* 54, 104
—— microthamnus *Becc.* 32
—— mirabilis VAR. oligocyclis *Becc.* 73
—— monticolus VAR. pinangianus *Becc.* 29
—— oblongus *Mart.* 59
—— ochrolepis *Becc.* 65
—— ochrolepis VAR. radulosus *Becc.* 66
—— oligophyllus *Becc.* 78
—— oxycarpus *Becc.* 53
—— pachyrostris *Becc.* 98
—— palembanicus *Bl.* 6
—— periacanthus *Miq.* 88, 89, 90
—— petiolaris *Mart.* 31
—— Pierreanus *Becc.* 8
—— propinquus *Becc.* 44, 45
—— pseudo-mirabilis *Becc.* 74, 75
—— pseudo-sepal *Becc.* 25
—— robustus *Warb.* 39
—— ruber *Bl.* 46
—— ruptilis *Becc.* 97
—— Sabut *Becc.* 77
—— Sarasinorum *Warb.* 38
—— scapigerus *Becc.* 87
—— Schmidtianus *Becc.* 7
—— Scortechinii *Becc.* 27
—— Sepal *Becc.* 24
—— singalanus *Becc.* 28
—— sparsiflorus VAR. crassifolius *Becc.* 103
—— sparsiflorus VAR. sarawakensis *Becc.* 101, 102
—— spectabilis *Becc.* 108
—— stenophyllus *Becc.* 14
—— tabacinus *Becc.* 33
—— Treubianus *Becc.* 23
—— trichrous *Miq.* 19
—— turbinatus *Becc.* 106
—— ursinus *Becc.* 35
—— vagans *Becc.* 62
—— verticillaris *Mart.* 68, 69
—— virescens *Becc.* 91

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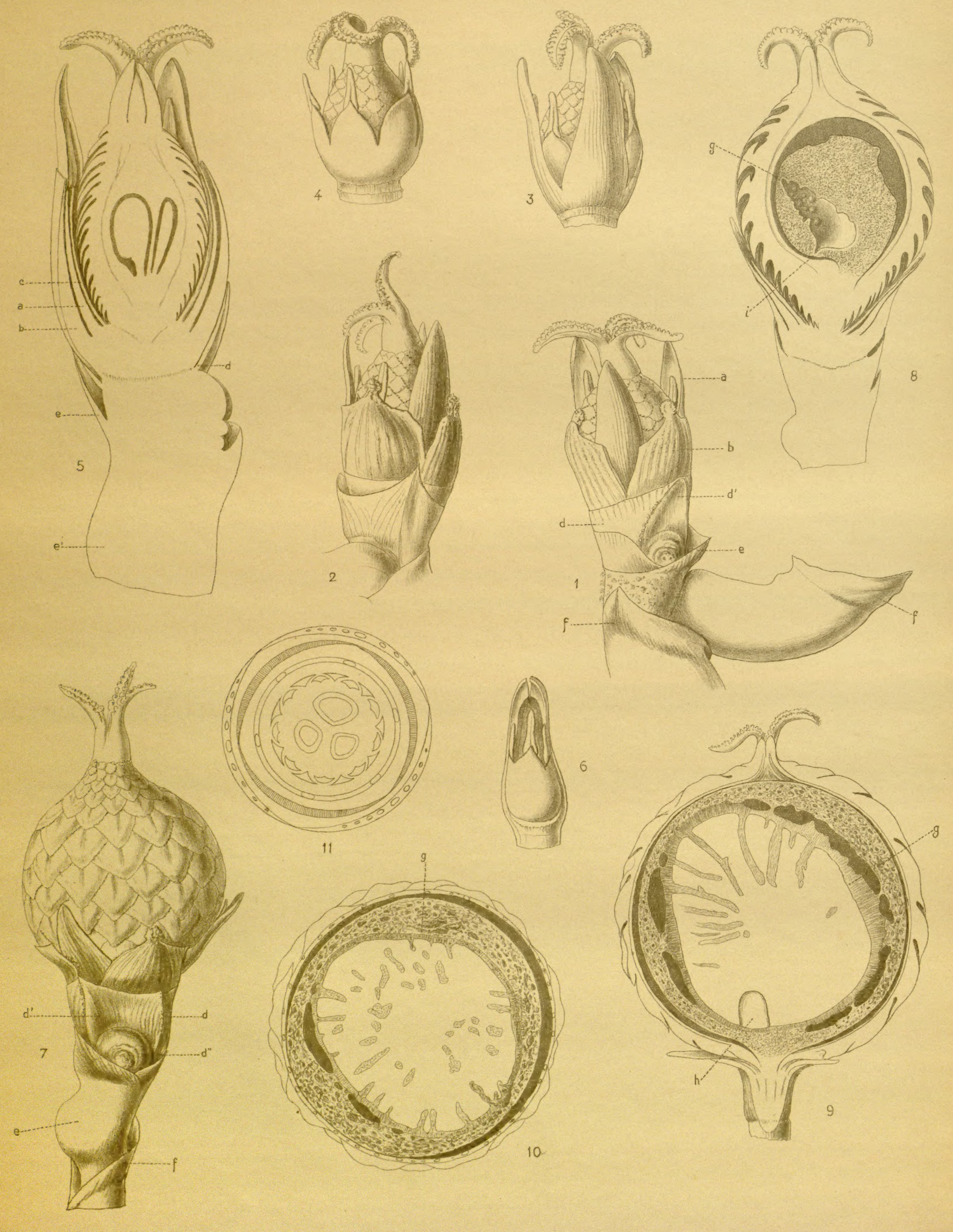
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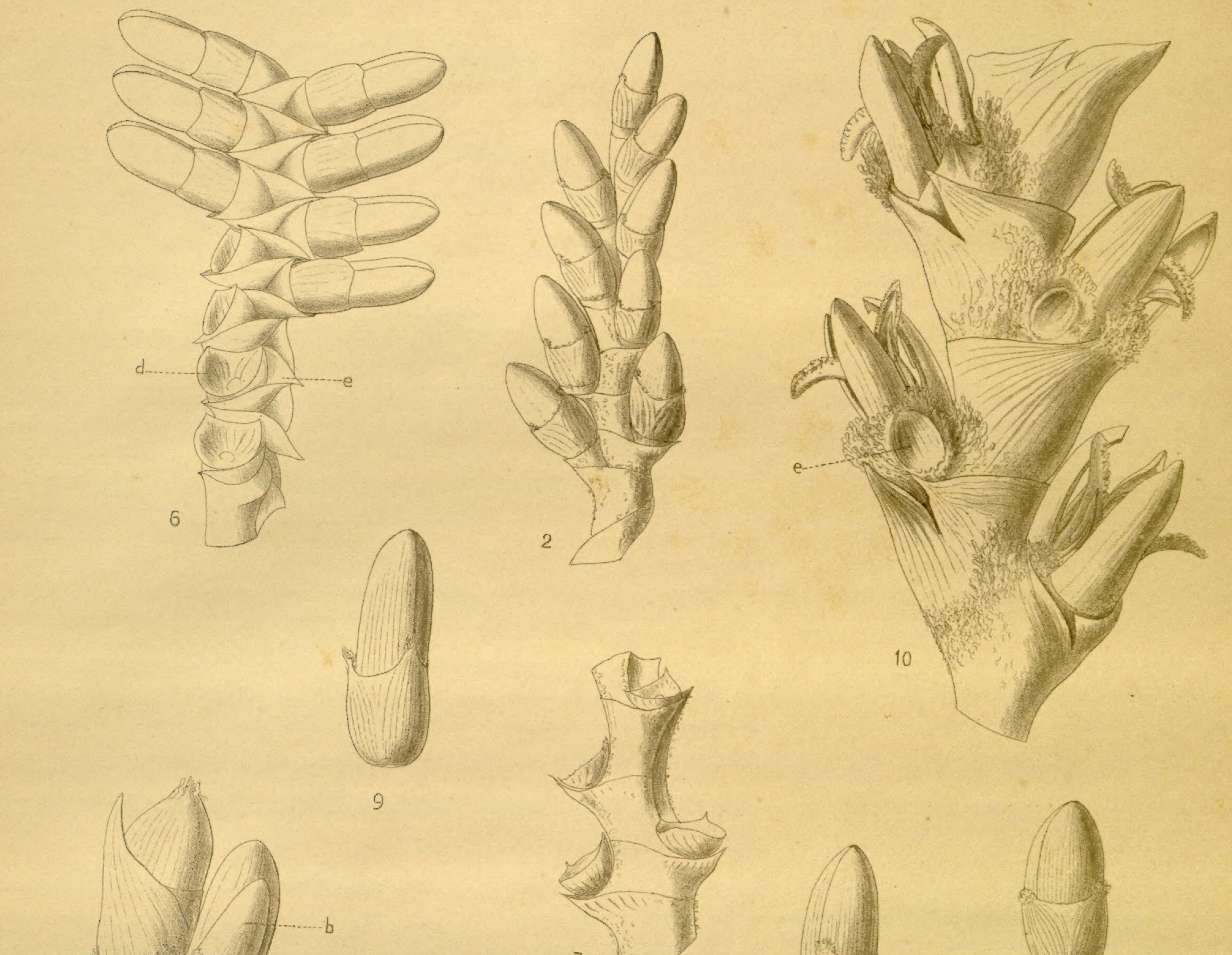
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FIG. 1-5 DAEMONOROPS JENKINSIANUS. FIG. 6-7 D. VERTICILLARIS.

FIG. 8-10 D. LONGISPATHUS